

Washington, D. C., Assembly—March 6, 7, 8, 9, 1950

VOLUME XV

NOVEMBER, 1949

NUMBER 11

The Southern Surgeon

DEC 7 1949

*Official Publication
of
The Southeastern Surgical Congress
The Southwestern Surgical Congress*

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Published Monthly

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THE SOUTHERN SURGEON PUBLISHING CO.

701 Hurt Building, Atlanta 3, Ga., U.S.A.

Entered as Second-Class Mail Matter June 25, 1946 at the Post Office at Atlanta, Ga., Under the Act of March 3, 1879.

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The Southern Surgeon

Vol. XV, No. 11

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November, 1949

VESICOVAGINAL FISTULA: 1849-1949

The C. Jeff Miller Memorial Lecture

CURTIS TYRONE, M.D.

New Orleans

IN 1849, a century ago almost to the day, and just 40 years after Ephraim McDowell had performed the first resection of an ovarian tumor in the backwoods of Kentucky, J. Marion Sims, in a little Alabama hospital, successfully repaired a vesicovaginal fistula in a negro slave named Anarcha and thereby made gynecologic history.

Although Sims is frequently credited with the performance of the first successful operation for vesicovaginal fistula, actually that credit does not belong to him, nor did he ever claim it. In his first publication on the subject,¹ in January, 1852, he outlined very carefully the history of the attempted repair of this lesion before his own successful case and listed, with equally scrupulous care, the previous successful cases of which he had knowledge: 3 by Dr. George Hayward at the Massachusetts General Hospital, in 20 operations on 9 patients; 2 by Dr. Pancoast of Philadelphia; 3 by Mr. Henry Earl, who in one of his cases performed "upward of thirty operations before success crowned his efforts"; and an unspecified number by Mettauer in America, "with leaden sutures," and by Jobert in France. In spite of these successes, however, Sims could still say with perfect fairness that, in the past, operations for this condition had almost always been unsuccessful and that, while some fistulas had "now and then been remedied," the number was so small that "no general principles of treatment could be established, and, consequently, no certainty of success, in any single instance, could be predicated." Sims' own operation upon Anarcha made gynecologic

Read before the seventeenth annual Postgraduate Surgical Assembly of The Southeastern Surgical Congress, Biloxi, Mississippi, May 23-26, 1949.

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history because, for the first time, operation was performed by a set of definite principles and succeeded because of them and not because of any fortuitous, albeit fortunate, set of circumstances.

THE STORY OF MARION SIMS

A vesicovaginal fistula is certainly one of the most distressing conditions it is possible to imagine. As Hayward² said in 1839, the consequences in the majority of cases are "of the most afflictive kind," and in 1851³ he was quoting Dieffenbach to the effect that "a pious resignation alone saves them [that is, women so afflicted] from self-destruction."

"The accident, *per se*," Sims¹ wrote in 1852, "is never fatal; but it may well be imagined that a lady of keen sensibilities so afflicted, and excluded from all social enjoyment, would prefer death. A case of this kind," he continued, "came under my observation a few years since, where the lady absolutely pined away and died, in consequence of her extreme mortification on ascertaining that she was hopelessly incurable."

Modern ladies, of course, do not pine away and die so readily, but any gynecologist knows from his personal experience of women with this condition who have become social recluses and have developed psychiatric complications of an extremely serious kind. Fortunately, while vesicovaginal fistulas are quite as distressing today as they were in the days of Hayward and Sims, they are less frequent, and they are almost never incurable. If they cannot be cured by direct means, they can be relieved by indirect means, though let me say here, as I shall say in more detail later, that there is seldom justification for a resort to complicated and dangerous methods before the simpler principles which Sims established a century ago have been given a fair trial.

Let me briefly repeat Sims' story. He had attended so many women, most of them slaves, with vesicovaginal fistula that their unhappy lot preyed greatly on his mind. Then in 1845, when he had two of them in his small hospital in Montgomery—it was little more than a hut—and was about to send them back to their masters as hopelessly incurable, he was called to see a lady who was in great pain after a fall from her horse. The pain, as was the custom of the day, was promptly attributed to a displacement of the uterus, and while he was hesitating over how to make a pelvic examination, he remembered a chance remark by a teacher in the Charleston Medical School and, in accordance with it, placed her in the knee-chest position. As he beheld the vagina fully ballooned out with air, it dawned on him that here was the solution of the visibility necessary for the repair of vesicovaginal fistula.

He forgot the 20 patients waiting for him "all over the hills of [his] beautiful city," and, stopping only to buy a pewter spoon from the store of Hall, Mores and Roberts, he rushed back to his office, picked up the two medical students then working with him, and hurried to the hospital to examine Lucy, the slave who was his immediate problem.

"Introducing the bent handle of the spoon," he wrote, "I saw everything, as no man had ever seen before. The fistula was as plain as the nose on a man's face. The edges were clear and well-defined and distinct, and the opening could be measured as accurately as if it had been cut out of a piece of plain paper."

So then he said to himself, "Why cannot these things be cured? It seems to me that there is nothing to do but to pare the edges of the fistula and bring it together nicely, introduce a catheter into the neck of the bladder and drain the urine off continually and the case will be cured."

The enthusiasm of this wonderful discovery raised him "into a plane of thought that unfitted him almost for the duties of the day," and "with gladdened heart, and buoyant spirits, and rejoicing in his soul," he made his rounds, feeling sure that he was "on the

Of course, it was not so simple as he had hoped. He had new eve of one of the greatest discoveries of the day." instruments made by the blacksmith, the dentist and the jeweler. He kept Lucy in his hospital, although he had been about to send her home, and he had Betsy sent back, and Anarcha sent back, and altogether he brought together 7 women whose fistulas had previously been regarded as incurable. But operation after operation failed, each failure bringing a fresh "degree of anguish." When his physician associates disappeared, one of them even denouncing him as a charlatan as he took his leave, he trained the patients to help with each other's operations. Neither he nor they wavered, and it warms the heart to read of those courageous negro slaves as they implored him "to repeat operations so tedious and at the same time so painful, that none but a woman could have borne them." What they had to endure is implicit in one of Sims' own simple comments, that after the completion of scarification the patient "rests a little" before the sutures are introduced.

Sims continued to work with a single aim although his practice suffered, his health was undermined, and financial troubles came upon him. He improved his tools. He developed a self-retaining malleable tin catheter. He modified the awkward and tiring knee-chest position into the semi-prone position we now know as the Sims position. He got rid of the clumsy vaginal apparatus he had been

using. He altered and improved his sutures. But still no operation was successful.

Then early one morning, as he lay in bed, there came to him a method of tying sutures so "simple and beautiful" that he "could not help waking up [his] kind and sympathetic wife" to tell her about it. And, not so long afterward, the chance finding of a small piece of fine brass wire suggested to him that silver wire sutures might be the solution of all his remaining difficulties. They were. The jeweler made the sutures on his instructions, "of all pure silver," and June 21, 1849, in his thirty-sixth year, he operated for the thirtieth time on Anarcha's fistula, this time with complete success. Within a few months he had also operated on, and cured, all the other women who had stood by him so loyally.

In 1852 Sims first reported his results, stating quite frankly, "Now I think I may say that almost every case of this hitherto intractable affection is rendered perfectly curable." For himself, he claimed originality on only three counts, (1) the operative position, that is, "the discovery of a method by which the vagina can be thoroughly explored, and the operation easily performed"; (2) the suture apparatus, "which lies imbedded in the tissues for an indefinite period without danger of cutting its way out, as do silk ligatures"; and (3) the self-retaining catheter, "which can be worn with the greatest comfort by the patient during the whole process of treatment."

In 1857,⁴ addressing the New York Academy of Medicine, Sims spoke very bluntly concerning his own estimate of his own achievements, of which he considered the introduction of silver wire the greatest. In evaluating his boastful words, one must remember that when, after a series of personal and financial and family misfortunes, he had finally settled in New York, he had, it is sad to relate, received the kind of reception which medical men all too often give to their confrères. Even the men who borrowed his instruments gave him no help. Perhaps he was remembering those things when he wrote:

"Silver as a suture is the greatest surgical achievement of the nineteenth century. For my own country I claim the honor of this imperishable discovery, and seize this auspicious occasion to place permanently upon the record a history of its origin and progress. Many of you already know that it was not the result of mere accident, but of long, laborious and persevering effort, based upon the immutable principles of science and forming one of the most beautiful examples of inductive philosophy. . . . The only thing comparable to it [silver wire] is etherization, and in practical results

of permanent benefit, it is absolutely contemptible, when compared with those from the universal use of silver sutures in the broad domain of surgery."

In view of these brave words it is somewhat saddening to find that Sims does not really deserve the credit for the first use of silver wire. An editorial in the *New England Journal of Medicine*⁵ in 1945 credits the discovery of Gossett's priority to the notation to that effect by George Hayward on a copy of Sims' 1857 address recently found in the Harvard Medical Library. But this was not the first mention of the matter. In 1940 Moir,⁶ in a delightful and scholarly account of Sims' work in the *British Medical Journal*, pointed out that Gossett, a London surgeon, had reported in the *Lancet* in 1834 that he had successfully repaired a vesicovaginal fistula with gilt silver wire, which, he noted, "excites but little irritation and does not appear to induce ulceration with the same rapidity as silk or any other material of which I am acquainted."

It is not only conceivable that Sims did not know of Gossett's work, it is inconceivable that he did. In view of the state of communications all over the world in 1834, the limited contacts between physicians, and the remoteness of the South, it is quite reasonable that he should never have heard of Gossett and his gilt silver wire. Moreover, Sims was not an ungenerous man. He made no claim to originality for most of his work, and he found it "equally a duty and a pleasure" to chronicle the successes which Hayward and Pancoast had achieved before him.¹

THE PRESENT STATUS OF VESICOVAGINAL FISTULA

Vesicovaginal fistula is a peculiarly appropriate subject for an address given in 1949, the hundredth anniversary of Sims' first successful operation, in memory of Dr. C. Jeff Miller. Sims died in 1883, 10 years before Dr. Miller graduated from the University of Tennessee Medical Department, and he had lived in New York for more than 30 years before his death. But to the surgeons of the South he was one of their own, and still vividly alive. Dr. Miller had a great admiration for him. Because he was a country boy himself, beginning to practice in a day when gynecology was still in a formative state, he was able to appreciate the hardships and disappointments and unremitting toil that underlay Sims' final successful achievement. Moreover, when Dr. Miller began to practice gynecology, vesicovaginal fistula was one of the most important of gynecologic problems.

It is not surprising that it was. One has only to read the transactions of the American Gynecological Society, which then, as now, stood for the best in medical practice in the diseases of women, to

realize how backward obstetric practice was. As late as 1895 M. D. Mann,⁷ in his presidential address, regretted that obstetrics did not occupy the attention of the Society to a greater degree. It was only necessary to announce a paper on an obstetric subject, he remarked, for half the membership to leave the room, while the number of hospitals in which obstetrics was being taught practically could be numbered on the fingers of one hand. In 1877⁸ a certain husband objected to cesarean section for his wife on the ground that he was used to stillborn children (his wife had had five) and preferred that she should take her chances with another craniotomy. But a decade later section was still being regarded as "one of the most dangerous operations in surgery." In 1878 Wilson⁹ was advocating digital curettage, supplemented by use of the nails, in postpartum hemorrhage, and in 1892 Ritchie,¹⁰ in a plea for accouchement forcé in placenta previa centralis, was protesting because "that admirable and useful instrument, the obstetric finger," was being "relegated to 'innocuous desuetude'." Discussions of the technic of craniotomy were commonplace. In fact, Lusk¹¹ wrote in 1888 that "the risk of craniotomy vs. Cesarean should be presented to the patient and her friends," who should decide between them. As late as 1895 symphysiotomy was seriously considered as an alternative preferable to cesarean section or craniotomy.¹² In 1894, McLean,¹³ after a courteously worded blast at specialists, who were likely to make "hasty and one-sided decisions," modestly presented his views in favor of the palliative treatment of uterine rupture.

In 1879 Johnson¹⁴ had put his finger on the cause of vesicovaginal fistulas and other obstetric injuries. Pointing out how in the transactions of the American Gynecological Society contributions on gynecology far outnumbered contributions on obstetrics, he remarked that "Two or three rash and unskillful practitioners in a city, who have somehow grown into a large midwifery practice, but who have failed to learn by experience, have been known to keep a gynecologist busy in treating diseases and repairing damages which greater obstetrical skill might have prevented altogether, or greatly lessened in severity."

Only the year before, Emmet's¹⁵ contribution to the program had clearly proved the truth of those remarks. Analyzing 161 vesicovaginal fistulas, which formed only part of the experience at the Woman's Hospital in New York (which Sims had been influential in founding), he pointed out that in every instance there were two clear causes for the injury, delay in delivery after arrest of the head, which was the direct cause, and neglect to empty the bladder before delivery, which was the indirect cause. As long as the head receded with each pain, he pointed out, there was no danger of damage to

the soft parts, no matter how long the labor lasted. It was only when the head became impacted that the patient was put in jeopardy. The solution of the problem was therefore the prompt application of forceps as soon as, and preferably before, impaction occurs. Sims,¹ almost 30 years earlier, had said precisely the same thing. Vesicovaginal fistula, he wrote, occurs principally in first labors, "where the pelvis is small, the soft parts unyielding, and the foetal cranium large." And while some writers might be disposed to attribute the causation of fistulas to the awkward use of instruments, his own experience showed that for one injury thus produced, the judicious application of forceps had prevented 50.

It was not surprising that vesicovaginal fistula should have been frequent when Dr. Miller first began to practice. Then, as now, Charity Hospital of Louisiana at New Orleans received many neglected patients, whose labors had been mismanaged, sometimes in the city, very often in the country. Colored women were chiefly cared for by untrained and ignorant midwives, but most white women, particularly in rural areas, were not much better off.

That situation has changed, it is true, but let no one persuade you that vesicovaginal fistula is even now an insignificant condition. In 1887 Skene¹⁶ was telling the American Gynecological Society that not enough of these lesions were being seen to permit satisfactory teaching, and I well remember that Dr. Miller again and again said the same thing. It is true that vesicovaginal fistulas of obstetric origin are becoming infrequent in the United States, England and other civilized countries, where competent obstetric care is available. Where it is not available, however, these lesions are continuing to occur. Only this year, for instance, Krishnan¹⁷ reported from one hospital in India 100 vesicovaginal fistulas, 98 of which were the result of difficult and mismanaged labor, chiefly in women with contracted pelves, whose babies were stillborn or died within a day or two. The Mohammedan religion, Thompson¹⁸ pointed out in a report of 42 cases treated at another Indian hospital in 1945, does not permit a woman to be treated by a male doctor, while the midwives (dais), who deliver literally millions of Moslem and Hindu women, have no scientific training at all and work entirely by tradition. The careless use of forceps is of course a contributory factor, but in India and everywhere else today, the cause of vesicovaginal fistula of obstetric origin is exactly what it was when Marion Sims was practicing, the prolonged pressure of the head on the soft parts, with distention of the bladder playing a secondary rôle.

Over the past 40 years there are entered in the files of the Record Library of Charity Hospital of Louisiana at New Orleans 458 vesicovaginal fistulas (fig. 1). In view of the improvement which

has occurred in obstetric practice, the relatively large number of cases observed within the last decade may come as a surprise to some physicians. Those who have practiced gynecology over this period, however, will find no difficulty in explaining these continued

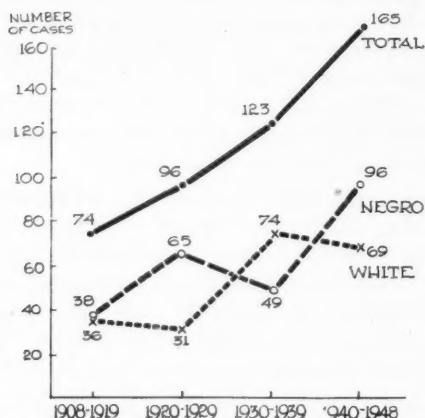


Fig. 1. Distribution by decades of 458 cases of vesico-vaginal fistula at Charity Hospital of Louisiana at New Orleans between January 1, 1908, and June 30, 1948.

admissions. Some fistulas are still of obstetric origin. A small number follow the application of radium, though in the hands of a careful radiotherapist such an accident almost never occurs. The great majority of vesicovaginal fistulas seen today, however, are of surgical origin and are even more the responsibility of the medical profession itself than were the obstetric fistulas of the last century: Midwives do not perform hysterectomy, but a great many physicians do who have no surgical training and who do not realize how difficult this operation can be. Furthermore, while I think all of us must be in full sympathy with the motives that underlie the increasingly widespread use of total abdominal hysterectomy, we should be fatuous indeed if we were unwilling to admit the increased risks that accompany its performance. The experienced gynecologic surgeon knows and fears the consequences of operation in a pelvis in which the relationships are distorted by the presence of multiple uterine fibroids or by the residua of pelvic inflammatory disease. The inexperienced surgeon does not, nor does he always realize how essential it is to operate with all structures fully visualized and with step-by-step control of bleeding.

Dr. Miller felt very strongly about the performance of hysterectomy by occasional operators—self-appointed specialists, as he

called them. He grew up medically, so to speak, in the days when hysterectomy was coming into general use and its technic was becoming standardized. He was used to performing it on colored women with enormous fibroids, the like of which we do not see today, and in pelves frozen from cellulitis and purulent exudates. He spoke very plainly on the subject of the misuse of the operation.¹⁹ Hysterectomy, he was wont to say, is a successful operation only when it is performed by properly trained surgeons. I am afraid those criteria are being met even less today than they were 17 years ago when in the Hodgen Lecture Dr. Miller wrote that hysterectomy was then being performed "with the lighthearted indifference to consequences that Oliver Wendell Holmes once described in another connection as 'the next step above an inclination to crime'."

I am also afraid that my own experience with vesicovaginal fistula is only too typical of the situation today. Since 1932 I have operated on 33 fistulas, one of which followed the application of radium, 7 of which were of obstetric origin, and 25 of which followed hysterectomy, performed 18 times by the abdominal and 7 times by the vaginal route. The age range in the series was 20 to 55 years, and the average age 36 years, which is considerably higher than the average age would be in a series of fistulas of obstetric origin. The most depressing thing about these cases is the fact that in only 12 of the 33 did I see the patients under optimum circumstances, that is, when there had been no previous attempt to close the fistula. Eleven of the remaining 21 patients had undergone one operation each, 6 had undergone 2 operations each, and 4 had undergone 3 operations each. These figures are in correspondence with those reported in other series. Only 15 of TeLinde's²⁰ 41 patients, for instance, came to him for the first attempt at closure, while 3 had each had 7 previous unsuccessful attempts at closure.

PRINCIPLES OF CLOSURE

General Problems. Certain difficulties are common to operation on all vesicovaginal fistulas. Dr. Miller²¹ 20 years ago described them as they still exist:

1. Operation must be done in what for all practical purposes is a body cavity, in which visibility is poor, to which access is often difficult, and in which manipulation is correspondingly awkward. This is especially true in postoperative fistulas, which are usually situated high in the vagina and which, like post-irradiation fistulas, often occur in virgins. Access, moreover, may be complicated by adhesions which narrow the vagina and sometimes almost occlude it.
2. The work must be done in a field which has been constantly

wet by urine, though today it is no longer infected urine. Effective chemotherapy and antibiotic therapy, both developed since Dr. Miller died, have taken care of that difficulty.

3. Hemorrhage is frequently troublesome, is sometimes excessive, and, because of the limited access, may be quite difficult to control. On the other hand, as Dr. Miller pointed out, free bleeding is a really hopeful sign, for it means that one is not working with devitalized tissues, in which healing cannot be expected. Destruction of the local blood supply, in fact, is one of the chief problems of post-irradiation fistulas and is one of the reasons why some authorities believe that in this type of fistula transplantation of the ureters should be resorted to without attempts to close the fistula by simple means.

4. Finally, even in simple fistulas, there is usually an abundance of scar tissue, which may be tough and unyielding, especially when the fistula follows irradiation or cauterization, or when previous attempts at closure have been made. Under the latter circumstances lines of cleavage may be entirely effaced and the surgeon may be left with almost no anatomic landmarks to guide him.

Principles of Repair. I also find Dr. Miller's description of the principles of repair of vesicovaginal fistula quite as valid today as they were when he set them down. He was a dexterous technician in everything that he did—his technic, in fact, was as dexterous as his judgment was sound—and the repair of inaccessible vesicovaginal fistulas, which to many another surgeon would have remained inaccessible, was among his most brilliant performances. He practiced the principles of Sims, and he would have heartily approved of the editorial writer who wrote in the *British Medical Journal* in 1940:²²

Full consideration must be given to every surgical measure capable of curing vesico-vaginal fistulae; the variations in the nature of the injury are such that no one type of operation can possibly give uniformly satisfactory results. Nevertheless there is little doubt that the simple, direct, and safe methods of Sims and Emmet have been put on the shelf far too long. It has been said that few can now handle their tools with the skill of their designers. But this is no reason why an operative technique that used to yield such consistent results should now pass into oblivion.

Dr. Miller preferred the lithotomy position for the operation, finding it quite as satisfactory as the knee-chest or the Sims position, and considerably easier on the patient. He agreed with Frank that both of the latter positions in a sense defeat their own purpose because they tend to increase the distance between the fistula and the vulvar orifice.

Accessibility was made much easier, Dr. Miller continued, when

the Mackenrodt principle of separation of structures was introduced, and he particularly approved of Ward's adaptation of the method to postoperative fistulas located high in the fornix. By this technic extensive dissection is combined with deep longitudinal and lateral vaginal incisions. Whatever the method employed, he contended, there must be wide separation of the structures, so that the bladder could be displaced downward, possibly aided by traction on the cervix, or, if necessary, by the release of adhesions above the vault. For all practical purposes, this technic involves opening the uterovesical space and mobilizing the intraperitoneal portion of the bladder.

The next principle which Dr. Miller always emphasized was separate suture of the bladder and the vagina, only the smallest lesions being suitable for joint suture. The mucous membrane of each structure must be inverted into that structure. If this is not done, they will inevitably grow together again and the communication will inevitably re-form. Dr. Miller was fond of citing Kelly's warning, that healing cannot be expected if two tissues with active function in opposite directions are united; by the laws of physics, they are bound to pull away from each other. He regarded suture of the bladder and vagina in different planes, with a layer of fascia interposed between them, as an added advantage but not a matter of vital importance.

On the question of suture material our position has changed since Dr. Miller wrote on vesicovaginal fistulas. Catgut, silk and silver wire, he pointed out, all have their place, though many objected to silk and linen on the ground that they favored the formation of stones. His own preference was for fine chromic catgut for bladder suture and for silver wire for the suture of the vesicovaginal fascia, on the ground that wire is always sterile, cannot be contaminated, as can absorbable suture material, has a definitely bactericidal effect, serves as a splint, and does not tear through the tissues. He usually secured it in place by small shots rather than by wire.

In the 33 vesicovaginal fistulas which make up my own series, linen was used in one case, quite early in the series, silver wire in 20 cases, and cotton in 12 cases. I still close the bladder mucosa with fine (#000) chromic catgut, but since 1942 I have used cotton exclusively for the vesicovaginal fascia and the vaginal mucous membrane. Healing has been rapid and complete in every case and the patient is far more comfortable than when wire sutures are used. The development of cotton as a suture material has occurred since Dr. Miller's death and there is, of course, no mention of it in his writings on the subject.

Miscellaneous Technics. Dr. Miller was so firmly convinced of

the soundness of Sims' principles of closure of vesicovaginal fistulas, and achieved such surpassingly good results with them, that it is not surprising that he looked with disfavor and distrust on most other methods. He opposed Kelly's suggestion that in some cases the peritoneal cavity should be opened from below. He took his stand, instead, with Ward and his associates, who contended that while incision and ligation of the broad ligaments might be a factor of safety in respect to the ureters, it also introduced the risk of permitting infected urine to escape into the abdominal cavity.

Theoretically, Dr. Miller granted, the combined laparotomy and vaginal technic might be useful for fistulas high in the fornix and fixed by scar tissue. Practically, he never performed this operation. He regarded it, indeed, as particularly undesirable because it made access to the fistula easier and thus threw the field open to surgeons inexperienced in pelvic work, who failed to realize that the abdominal incision introduced an element of risk not present in vaginal manipulations. How unnecessary the abdominal approach is can be judged from Krishnan's¹⁷ remark, that he used this technic in only one of 100 operations, and that that case could be explained by his inexperience.

Dr. Miller had very little use for the type of operation in which portions of the uterus or cervix are used to close the fistula. He condemned all types of colpocleisis. In this point of view he was in accord with Sims,¹ who said of Vidal's operation in which the vulva was used as an obturator that thereby "the bladder and vagina become a grand compound receptacle of the urine and menstrual secretion. It would be an idle waste of time," he continued, "to dwell longer on means so perfectly ineffectual, not to say mischievous." I am not aware that Dr. Miller ever had any experience with suprapubic drainage, but I feel certain that he would have regarded it as an unnecessary complication of an essentially simple procedure. The truth is that he was himself so successful with the simpler methods that it is easy to see why he condemned the complicated and the bizarre. He would certainly have said with Moir,⁶

"Sims's position, Sims's speculum, Sims's method of edge-paring, and Sims's silver wire could achieve the seemingly impossible a century ago and they can do it now."

Implantation of the ureters into the intestine Dr. Miller performed only occasionally and only on the strictest indications. Unless the vesical sphincter was irreparably destroyed he did not even consider it. He would have been entirely in accord with Thomas,²³ who wrote in 1945 that if a large series of ureteral transplantations were reported, "one should enquire what percentage of the total

number of fistulae seen the series represents. Too frequent performance of the operation is to be deplored." How correct his contention was is evident in the article¹⁸ which immediately follows his in the *Journal of Obstetrics and Gynaecology of the British Empire* for June, 1945. In a series of 42 vesicovaginal fistulas in Indian women, 13 cases were treated by various modifications of the ureteral implantation operation. All 13 fistulas were regarded as inoperable by simpler methods and one cannot, of course, take issue with that point of view. But 5 deaths in 13 operations is certainly not a mortality to be viewed with complacency. Sims, it will be remembered, had only 1 death in his own enormous experience, and that, ironically, occurred in a demonstration case in London, in which he inadvertently included the ureters in the sutures.

I can myself bear witness to the effectiveness of the simple principles of repair which Dr. Miller taught and practiced. The 33 vesicovaginal fistulas which I have operated on since 1932 were successful in all but one case, although in 21 cases, as I have already pointed out, previous attempts at repair had made operation more difficult than it would have been if the patients could have been seen soon after their injuries. Yet transplantation of the ureters proved necessary in only one instance, a post-irradiation fistula, in a woman with extensive malignant disease. In 31 of the 32 other cases the fistulas were successfully closed, on the first attempt, by the vaginal route, and by the application of the principles which I have just outlined. I might add that the single failure occurred in a postoperative fistula, in a patient with an intractable *Bacillus proteus* infection of the bladder, in the days before sulfanilamide and other chemotherapeutic and antibiotic agents had been introduced.

PREOPERATIVE AND POSTOPERATIVE CARE

Dr. Miller was very exacting in the matter of preoperative and postoperative care. He delayed sufficiently long—at least 3 months and frequently longer—after delivery for full involution of the genital tract to occur in fistulas of obstetric origin, and usually delayed at least as long in postoperative fistulas. He employed cystoscopy to determine the size and position of the fistulous opening and its relationship to the ureters and urethra, but he never submitted his patients to unnecessary tests. Hot sitz baths, vaginal douches, bladder irrigations, occasional applications of nitrate of silver, and the use of such antiseptic measures as were then available were all part of his preoperative regimen. Today, of course, the availability of sulfonamides and antibiotics has made the control of infection simple, and the gynecologic surgeon who undertakes to close a vesico-

vaginal fistula is spared anxiety from that source, though that does not mean that he should not wait the specified time before he operates.

In Dr. Miller's emphasis on the importance of postoperative care he was the true child of Marion Sims. The principle of the self-retaining catheter, by means of which the suture line can be kept free of urine, is as important now as it was when Sims first introduced it. Dr. Miller to the end of his life preferred the block tin catheter which Sims had devised, because he thought it less likely to slip out or to corrode than the more modern types. He was also emphatic that if the catheter slipped out, the surgeon should replace it himself, or—as I know very well—should send his first assistant to do it. Internes and residents were forbidden to do anything but notify him that the catheter was out. He kept the catheter in place for a minimum of 10 to 12 days, which was longer than was usually advised, and he made certain, before it was permanently removed, that the vesical capacity was carefully checked and that the patient was completely emptying the bladder when she voided voluntarily. Incidentally, one wonders how Hayward^{2,3} succeeded in closing any fistulas successfully since he apparently permitted his patients to remove and replace their own catheters several times daily, sometimes immediately after operation.

Sims limited his patients after operation to tea, coffee and crackers, though he gave them water freely when once he had perfected his self-retaining catheter; previously he had limited even that. Hayward's^{2,3} unfortunate patients were given only thin arrow root, milk, water, and "a solution of gum arabic." Sims¹ deliberately kept the patient constipated. Dr. Miller as carefully guarded against constipation. He used narcotics in moderation for a day or two, but naturally did not agree with Sims that opium "... calms the nerves, inspires hope, relieves the scalding of the urine, prevents craving for food, produces constipation, subdues inflammatory action, and assists the patient, doomed to a fortnight's horizontal position, to pass the time with pleasant dreams, and delightful sensations, instead of painful forebodings and intolerable sufferings."

Dr. Miller, like Sims, kept his patients in bed for a fortnight, though not in the horizontal position. They were free to move about as they wished. The present practice of early ambulation had not been introduced, or, more correctly, revived, in his lifetime, but it has no place in vesicovaginal fistula. The present practice is to keep the catheter in situ for 11 days and to permit ambulation as soon as it is removed. Until then, the patient must remain in bed.

DR. C. JEFF MILLER

In 1942 the late Dr. Hilliard Eve Miller delivered the memorial lecture²⁴ instituted to honor the memory of his brother, Dr. C. Jeff Miller, who died in 1936, during the meeting of The Southeastern Surgical Congress at which he was to assume the office of president. It was appropriate that Dr. Hilliard Miller should deliver that lecture, just as it is appropriate that Dr. Conrad G. Collins²⁵ should have delivered it in 1946, and that I should deliver it in 1949. We were all of us products of Dr. Jeff's training, and whatever we became, we owe to him.

It was my own privilege to be associated with Dr. Miller for 14 years, first as a medical student, then as an interne and resident, and finally as his assistant and associate. I doubt that any man ever had better training or greater opportunities in clinical gynecology than Dr. Miller gave to me.

Dr. Jeff Miller, as his brother pointed out in his memorial lecture in 1942, entered the University of Tennessee Medical Department in 1891, when he was only 18 years old, and when medical education was in a state of incredible chaos. He had no formal premedical training, as the modern student would understand the term, though he had at least one advantage over most of the medical students whom I know and whom I have known: He was very widely read. To the end of his life reading was his greatest delight. He was graduated in 1893, after only 10 months of medical instruction, chiefly didactic lectures, along with the other 114 students who had entered with him 2 years before. There were no failures in that class, which you may interpret as you will. He had an internship at the Nashville City Hospital, he taught for a brief period at Sewanee, he practiced for a few months with his uncle, a "doctor of the old school," and then, in 1894, he came to New Orleans, where he spent the remainder of his busy, useful life. He rose from the lowliest position in the Charity Hospital Clinic to the highest position that could be given to him in the Tulane University School of Medicine, and he had also the highest honors his profession could give him, the presidency of the Southern Surgical Association, the American College of Surgeons, the American Gynecological Society, and this organization. It is interesting and significant that one of his classmates at the University of Tennessee, the late Dr. William D. Haggard, succeeded him or followed him in the presidency of the Southern Surgical Association, the American College of Surgeons and this organization, and was also the President of the American Medical Association. I know it would have given Dr. Miller pleasure to realize that the first Miller Memorial Lecture²⁶ was delivered by his old and good friend, Dr. Will Haggard.

Dr. Hilliard Miller tried to analyze why his brother, with a medical education that by present-day standards is ludicrous, with no formal clinical training at all, should have become one of the most distinguished clinicians in his own field in America. Dr. Jeff Miller, he said, had an insatiable curiosity, a limitless ambition, an eager enthusiasm, a knowledge that he had been trained for a profession which had its own peculiar dignity, its own sense of the value of human life, its own special concepts of conduct and behavior and action. He had the merit of being the product of his own experience. He never forgot that only by "hard toil, high courage, eternal sacrifice, bitter disappointment . . . are visions translated and dreams brought to pass."

In his position as Professor of Gynecology and, earlier, of Obstetrics, at the Tulane University School of Medicine, Dr. Miller exerted a profound influence on the practice of obstetrics and gynecology in the South. Hundreds of men whom he taught are practicing in every part of the country, but chiefly in the South. I don't think it is possible to overemphasize the value of his teaching. As Dr. Will Haggard well expressed it in the first Miller Memorial Lecture, he represented "The skillful, conscientious surgeon . . . who, in the ripeness of his unerring judgment, knows when to stay his hand as well as when to employ operation." In the management of pelvic inflammatory disease, uterine fibroids, ovarian cysts, the toxemias of pregnancy, septic abortion, puerperal infection, and a dozen other diseases of women he taught and practiced conservatism and the conservation of tissue and of function. Many hundreds of women had happier and fuller lives because they came under his care, and thousands more have had happier and fuller lives because they have been cared for by the men to whom he taught his own professional principles.

It is a privilege for me, because I was his student, his associate and his friend, to pay this tribute tonight to Dr. Jeff Miller, before this organization which he did so much to foster and encourage in its earlier formative years. Those of you who knew and admired him and loved him know how richly he deserved any tribute that could be paid to him. Those of you who did not have the honor of association with him have missed one of the unforgettable experiences of a medical life. He represented the best that there was and could be in American gynecology and obstetrics. It is the responsibility of those of us whom he taught to try to follow in his professional footsteps and to practice the precepts which he taught and which he practiced himself to the last day of his medical life.

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POSTCHOLECYSTECTOMY PAIN

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THE general results from cholecystectomy for disease of the gallbladder are among the best in the field of surgery, excellent results being obtained in approximately 90 per cent of cases. Best results are those obtained where the gallbladder is the site of severe infective cholecystitis or cholecystitis with stones. The results are markedly less favorable in cases of noncalculous cholecystitis and those with minor degrees of cholesterolosis, unless definite biliary colic is present.

It is that 10 per cent of cases whose results are not so good that I am interested in and wish to improve, for today there is scarcely a patient with proved gallbladder disease who does not hesitate to submit to surgery because he knows several other people who have had cholecystectomy with only temporary relief of pain and then persistence of all, or most, of the symptoms previously experienced.

Generally the most frequent causes of pain following cholecystectomy are:

1. Remaining common duct stones or biliary stones.
2. Erroneous diagnosis and poor selection of cases for operation.
3. Residues of cholecystic disease, such as inflammatory lesions of the liver, bile ducts, or pancreas, and adhesions.
4. Trauma to the common duct at operation.
5. Cystic duct remnant and/or cystic neuroma.
6. Biliary dyskinesia or spastic sphincter of Oddi.

Formerly, at least in the textbooks published, when I was exposed to them, erroneous diagnosis was considered to be the most prevalent cause. However, today with improvement and more common use of the Graham-Cole test for gallbladder function and visualization, as well as gastrointestinal, genitourinary and cardiac investigation, it is thought that errors in diagnosis are becoming less frequent.

It is my belief that overlooked common duct stones present at surgery is the most frequent cause of symptoms following cholecystectomy today. It is true that stones may form in the common duct after surgery as a result of cholangitis and it is equally true according to figures by Walters and Balfour and by Maingot, Best and others that liver stones are present in 7 per cent of cases of chole-

lithiasis and that these may become dislodged following surgery and pass into the common duct. Despite these sources, by far the great majority of common duct stones are formed in the gallbladder and pass into the common duct.

Common duct stones occur with cholelithiasis in from 15 per cent to 25 per cent of cases. Lahey reported 1,800 cases in which the common duct was explored 531 times (30 per cent) and stones were found and removed in 258 (15 per cent). In a later series he reported stones in the common bile duct removed in 20 per cent of the cases. The incidence of common duct stones is therefore more prevalent than usually believed or sought for.

As for erroneous diagnosis gallbladders are still removed because of nonvisualization without seeking to ascertain where gastrointestinal disease has prevented the absorption of the oral dye, whether the tablets have been vomited, or whether liver disease has prevented their absorption. Peptic ulcers are overlooked and gallbladders removed without adequate investigation. Kidney stones, pancreatitis, colitis, and diaphragmatic hernia, as well as coronary disease are still being overlooked preoperatively, although as has been previously mentioned, it is believed that the percentage is decreasing.

Residues of cholecystic disease seated in the liver, pancreas or biliary tract in about 20 per cent of the cases will present symptoms of flatulent dyspepsia and sometimes right upper quadrant pain. These symptoms are usually mild and will persist for weeks to months and then disappear. The same type symptoms may also persist which are apparently due to postoperative distention of the common and hepatic ducts and the resumption of sphincteric tone. These also usually subside within a few weeks and are less severe than the preoperative pain.

Trauma to the common or hepatic ducts still occurs at operation. These accidents are followed by the usual biliary symptoms coming on within days or months. This is an avoidable factor and with adequate exposure of the biliary tree should not occur.

There is another group of cases formerly thought to be a portion of that large group considered merely as biliary dyskinesia in which none of the previous conditions exist where the patient after several months begins again to complain of severe colicky right upper quadrant pain accompanied by nausea and vomiting and flatulence and in some cases transient and mild jaundice. It is this group still incompletely explained on which a great deal of work has been done in the past few years. I refer to the cystic duct remnants and the cystic neuromas. Cole and Rossiter, Gray and Sharpe, Hicken,

White and Coray, and Morton have investigated the rôle of incomplete removal of the cystic duct in the production of postcholecystectomy pain. Each has reported from a few to several cases in which, after all other factors were eliminated including exploration of the common duct, good results, that is cessation of symptoms, have followed removal of the cystic duct remnant. I have had occasion to explore 2 such cases. In one case it appeared the cystic duct and cystic artery had been ligated together. This, of course, increases the likelihood of allowing a long cystic duct to remain. We are cautioned in our textbooks to ligate the cystic duct as far as possible from the common duct to prevent injury to it. Actually the cystic duct should be ligated only after clear visualization and then should be ligated within 2 to 4 mm. of the common duct.

Womack and Crider have reported a number of cases in which pain persists in a like manner. They also report finding large cystic duct remnants but felt that it was not the large cystic duct but rather the inclusion of bundles of nerves from both the parasympathetic and the sympathetic origin in the scarred walls of the duct that produce the symptoms. They state that at times fibrous tissue proliferation and nerve trunk regeneration may form nodules resembling amputation neuromas. Both anterior and posterior plexuses of nerve fibers tend to converge in the region of the cystic duct, so that it is quite easy to include many of these fibers in the ligature about the cystic duct. There may not be actual neuroma formation at the time, but constriction and ischemia of the nerve fibers in this region which are subject to variation in the changing intraductal tension during the course of the day. They cite the case of a thin young girl who apparently had a normal gallbladder removed with damage to the common duct. Following surgery she developed typical biliary pain. Scar tissue with compression and scarred nerve supply were found at second operation. The nerves thus enmeshed have a lower threshold for pain and react to lesser stimuli.

The separation of the latter group should leave a smaller group of the so-called biliary dyskinesias. These are thought to be due to a spastic sphincter of Oddi.

The method of preventing postcholecystectomy pain then is more thorough diagnosis with emphasis on exacting and painstaking examination of the gastrointestinal tract, kidneys, pancreas, and cardiac status; repetition of gallbladder visualization tests which are equivocal, more curiosity as to the presence of common duct stones, and careful and thorough surgery at removal of the gallbladder.

Relative to the presence of common duct stones since they are

actually so prevalent as previously mentioned it is believed that we should widen our scope of indications for exploration of the common duct. The mere absence of bouts of clinical jaundice, clay colored stools, or even absence of an elevated icterus index should not deter us from exploring the common duct where small stones are present in the gallbladder. The gallbladder should be opened and the size of the stones observed before closing the abdomen at the time of surgery. Where small stones are present I believe the common duct should be opened and explored even if signs of common duct obstruction are absent. I believe that more common duct stones will be found in this manner and fewer poor results will occur. Just this past week I found 15 small stones in a common duct in which the usual symptoms were absent. Following surgery, on being closely questioned, the patient did remember occasional occurrences of dark urine. When the common duct is explored it is felt that the cystic duct should be ligated first, in order that small stones present in the gallbladder may not be forced into the common duct when the cystic duct is clamped or crushed. Following common duct exploration and the placing of the T tube cholangiograms may be made during surgery, immediately following, or before removal of the T tube. Formerly I routinely made cholangiograms before removal of the T tube. I now believe that where conditions permit it is well to take cholangiograms before closing the abdomen so that remaining stones or defects may be found and remedied at the time of surgery and not delayed.

If stones are found to be present in this manner they may be removed at the time or in some cases removed by the Pribran treatment in which ether is instilled into the common duct in order to dissolve the stone. This procedure is usually followed by some to a great deal of pain, particularly on the first instillation, but this may be decreased somewhat by using olive oil to follow the ether. I have used this method on four or five occasions with good results. It has been stated by some that the results are obtained in this method actually by the pressure produced on the sphincter of Oddi allowing the stone to pass. In this respect I may only say I have been unable to produce the same results with sterile water.

Adhesions may at least be partially avoided by careful peritonealization of the gallbladder bed. Trauma to the biliary tract and common and hepatic ducts may be avoided by adequate exposure and good visualization of the three ducts before clamping the cystic duct. Cystic duct remnants and cystic neuromas may be avoided by careful dissection of peritoneum and areolar tissue overlying the common duct, as stressed by Womack and Crider, prior to removal

of the gallbladder. They advocate further the separation of the nerve trunks medial to the common duct.

Cases of biliary dyskinesia will still persist to be treated medically. I have 6 cases to report which represent different causes of postcholecystectomy pain following surgery. These cases are not unusual but are presented as evidence that no one etiologic factor is responsible for the pain following gallbladder surgery.

CASE 1. Mrs. S. B. B. was a 67 year old white female, admitted to Mississippi Baptist Hospital, July 21, 1948, with the complaint of pain about the right upper quadrant in the region of the old scar. She had been operated upon for gallstones in September, 1944. Following the operation she had no difficulty until November, 1947, when she began to have colicky pain just as she had had before. This was accompanied by jaundice and dark urine, chills and fever. She had had six attacks of similar nature during the intervening period. Icterus index on last admission was 15. Common duct exploration was done and two common duct stones were found. Recovery was uneventful. The common duct had not been explored at the first operation although small stones were found.

CASE 2. H. D. C., a 53 year old male, was admitted to the Mississippi Baptist Hospital on Jan. 22, 1948, with complaint of "gas on stomach" with severe heart pain. He had been told that he had "heart trouble," and on this admission was brought in by ambulance after having a pulmotor squad dispatched to his house because it was thought he was having a severe heart attack. On questioning and examination a normal heart was found and the history elicited that the pain was like that he had had prior to cholecystectomy in 1925, but much worse. He had had recurrent attacks for 10 years and had been diagnosed as "psychoneurosis" on one hospital admission with similar complaints. On this last admission icterus index had been normal. There was no jaundice and no urinary bile. At exploration on January 24 an elongated cystic duct remnant was removed and adhesions which were quite dense were freed between the pylorus and gallbladder bed. There were no stones in the common duct. Convalescence was uneventful and he is still symptom free and able to eat and work better than at any time in the past 10 years. The pathologic report was scar tissue from the cystic duct remnant.

CASE 3. Mrs. C. J., aged 38, was admitted to St. Dominics Hospital Nov. 7, 1947, with symptoms of flatulence, colicky pain in the right upper quadrant, nausea and vomiting. Gastrointestinal series was entirely negative and the icterus index was normal. Stool examination, blood and urine analyses were negative as was gastric analysis. Past history revealed that she had had a cholecystectomy and appendectomy in 1938. The pathologic diagnosis was cholecystitis, chronic, without stones, and chronic appendicitis. Symptoms were relieved for about 2 years to a moderate degree when they became more severe than they had formerly been. The chief symptoms then being huge amounts of "gas on the stomach" and pain about the old right upper quadrant scar. On November 15 an exploratory operation was performed, dense adhesions were freed up between the stomach and gallbladder bed, the common duct was explored and no stones found. Dense adhesions about the common duct were freed on both sides of the duct and an elongated cystic duct remnant removed

which was 22 mm. in length and it appeared to have been ligated with the cystic artery. T tube was inserted and the omentum was sutured between the denuded liver bed and stomach. She has been symptom free since.

CASE 4. Mrs. F. D., aged 68, was admitted to Mississippi Baptist Hospital on Jan. 30, 1947, with symptoms of colicky pain in the right upper quadrant radiating to the right shoulder, jaundice, pruritis, and nausea and vomiting. Icterus index was 30. She had had cholecystectomy and common duct exploration in 1945. At that time no stones were found in the common duct but it was explored because of dilatation. T tube was inserted. She continued to have pain after about 6 months but it was mostly in the neck and right shoulder. She was treated by stellate ganglion block and neck traction, the latter seeming to give some relief. However, following this treatment she became jaundiced on two occasions. On February 10, she was again explored. The common duct, which showed only acute angulation and mild dilatation, was opened and explored. No stones were found. T tube was inserted. Two weeks later cholangiograms were made revealing intrahepatic stones. Ether was instilled into the T tube daily for 7 days. The T tube was removed after 2 months. Patient is now well except for some neck pain.

CASE 5. Mr. H. Y., aged 52, was admitted to Mississippi Baptist Hospital March 30, 1949, with typical gallbladder symptoms with jaundice. On April 1 the gallbladder containing sand and small stones was removed and the common duct explored, sandy material being found at the sphincter of Oddi. A T tube was inserted and on the eighth postoperative day patient had clay-colored stools. A cholangiogram revealed obstruction of the common duct at the sphincter as by a small stone. The obstruction was complete. Ether was injected twice daily until the fourteenth postoperative day when re-exploration was considered but a repeat cholangiogram showed that the obstruction had been removed. Convalescence was uneventful.

CASE 6. Mr. R. L. P. was admitted to Mississippi Baptist Hospital on March 12, 1948, with a history of pain in the right upper quadrant with nausea and vomiting, without jaundice or obstructive common duct symptoms. Cholecystectomy was performed; the common duct was not dilated and palpation did not reveal stones. The stones in the gallbladder were moderately large and the common duct was not explored. Convalescence was uneventful for about 6 months when he began to have epigastric pain again. This time it was somewhat different and was worse before meals, although not completely relieved by them. He was again referred to me by the original referring doctor who thought I had allowed stones to remain in the common duct. I was fearful that this was truthfully the condition. However, x-rays of the stomach revealed a gastric ulcer which healed rapidly on conservative therapy. This relieved my embarrassment.

In summary, the most frequent causes of postcholecystectomy pain have been brought out with emphasis on remaining common duct stones. Methods of prevention of postcholecystectomy pain have been discussed, again with emphasis on more frequent exploration of the common duct, particularly where small stones are found in the gallbladder and even in the absence of definite common duct obstructive symptoms.

Six cases are presented representing different pathologic causes of postcholecystectomy pain.

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PRESIDENT'S ADDRESS*

THE HUMAN OVARY: AM I MY BROTHER'S KEEPER?

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RACIALLY, the ovary is probably the most important organ of the female and it is the surgical conservatism of it that I had in mind when I chose this title for my paper. I shall discuss the ovary from the standpoint of genetics, embryology, structure, physiology and pathology, as well as surgery.

How we develop before we are born has always been a matter of intriguing interest. "Where did I come from?" is one of the child's first thoughtful questions. The knowledge that the adult body was composed entirely of cells and cell products paved the way for a realization of the basic fact of embryology, that the body of the new individual is developed from a single cell, the cell formed by the union in fertilization of a germ cell contributed by the male parent with a germ cell contributed by the female parent. Thus, although curiosity had been at work since before the time of written history (and with Aristotle critical observation had begun to replace conjecture), it was not until the development of the microscope, the advent of the experimental method, and the discovery of the cellular structure of the body that embryology began to become a science.

"The Anatomy of Human Embryos," by Wilhelm His, published in 1880, was the first outstanding work and the foundation of our modern knowledge of human development.

Continuity of Germ Plasm: The germ cells (sex cells or reproductive cells), which are the spermatozoa of the male and the ova of the female, are collectively known as gametes. In the process of fertilization, a male and a female gamete unite to form a single cell, the zygote, from which a new individual develops. The cells which take no direct part in the production of gametes and which cease to exist with the death of the individual are called somatic cells. Thus, among the myriads of cells that make up the individual and the organs that maintain his vegetative existence (brain, liver, heart, kidneys, bone, etc.) there are a limited number of germ cells that function in the perpetuation of the race—an unbroken line that has existed since the beginning of life on earth. The conjugating gametes alone pass on the entire hereditary dowry of the species,

*Read before the seventeenth annual Postgraduate Surgical Assembly of The South-eastern Surgical Congress, Biloxi, Miss., May 23-26, 1949.

not only from the immediate parents but also from all their ancestors.

Since all of us are "mosaics" in inheritance, low-grade offspring may occasionally confront intellectual and successful families with the defects of a forgotten ancestor, and highly successful sons and daughters may appear in the homes of the ignorant and indigent as reminders of a brighter past. Yet in spite of these conspicuous and much overemphasized sporadic cases, biologic laws are inexorable and, by and large, "like begets like." That child must be considered most fortunate who has "selected his ancestors" with the greatest number of good traits to take after (Novak).

To recognize the fact that heredity is of outstanding importance does not belittle the significance of environment. Heredity provides the materials on which environment operates, but environment determines how well these materials are conserved and utilized. A crude analogy may be drawn from our everyday experience with instruments or machines. What is built into them in their manufacture corresponds to what we receive by heredity; the manner in which they are subsequently used corresponds to environment. No amount of intelligent use and careful maintenance can make a mechanism fabricated of poor materials into a long-enduring and highly efficient instrument of precision. However, abuse of a potentially fine mechanism may make it function far less satisfactorily than a similar mechanism made of poorer materials but used with intelligence and conserved with care. Environment creates nothing. Its importance lies in the way in which it determines how fully we realize, or how tragically we fall short of, our hereditary potentialities.

Each germ cell has its inheritance, which gives it the potentiality of developing almost exactly as its lineal ancestors did before it—ALMOST EXACTLY for in some yet unknown way some germ cells do change, as evidenced by the fact that species now and again show the sudden changes which the geneticists call mutations.

It was only recently that real mutations were artificially induced by massive doses of x-rays. The mutants thus produced "breed true," that is, the offspring exhibit the peculiarities induced in their parents when the parents were still in the gamete stage. Such cases may be classed in a broad sense as "inheritance of acquired characters," and constitute the only ones that may be considered proved.

Atresia of Follicles: By no means do all the follicles that start to enlarge go on to ovulation. Ordinarily, a woman will bring to maturity but a single ovarian follicle each four weeks.

The history of an ovarion follicle is by no means closed when it has liberated its contained ovum. There remain in the ovary the

great bulk of the follicle cells and the connective-tissue theca which surrounded the follicle before its rupture.

The maturation of the ovum (primary oocyte) begins at just about the time of its liberation from the follicle. As in the male, two divisions occur in rapid succession, but instead of four functional gametes being formed as an end result, there is in the female only one.

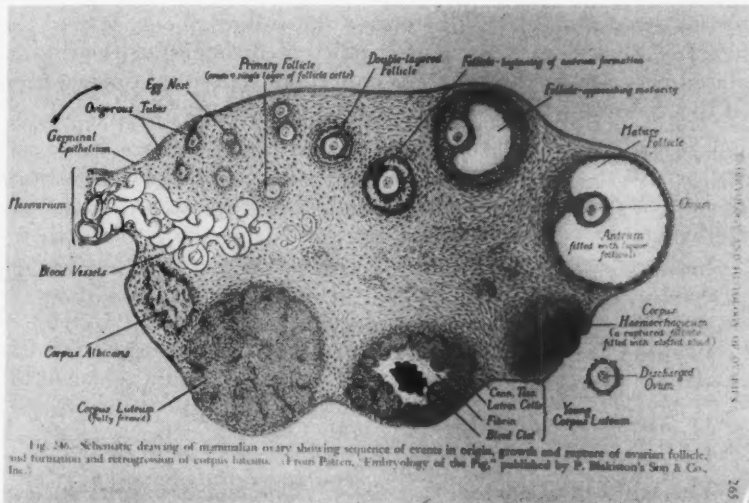


Fig. 246. Schematic drawing of mammalian ovary showing sequence of events in origin, growth and rupture of ovarian follicle, and formation and retrogression of corpus luteum. (From Patten, "Embryology of the Pig," published by F. Makinson's Son & Co., Inc.)

Almost the entire reproductive and urinary systems of both sexes are formed from the wolffian body, a large and important structure occupying the posterior or dorsal portion of the primitive peritoneal cavity. The anlage of the sex gland appears very early in fetal development as an aggregation of cells on the anterior aspect of the wolffian body covered by the primitive peritoneal or celomic epithelium. It is not certain what determines the male or female direction in the sex glands. This early stage is soon followed by one in which the cells arrange themselves into sex cords or columns which anastomose and converge toward the hilum. The mesenchymal cells then develop into either granulosa (epithelial) or thecal (connective tissue) cells. Common origin from the mesenchyme explains the close functional kinship and the apparent histologic intermutability of granulosa and thecal cells. Covering the ovary is the germinal epithelium often spoken of as a modified epithelium covering the gonad (Patten).

The completion of the differentiative processes above described results in the formation of an enormous number (computed as sev-

eral hundred thousand) primitive follicles, each containing a germ cell or oogonium. The prevailing theory is that no new ova are formed in the later life of the woman although there is evidence from studies on animals that the process of ovum formation may go on throughout reproductive life.

The ovary is divisible into the cortex and the medulla. During reproductive life the former is broad, constituting from one half to two thirds of the depth of the ovary. It consists of a very characteristic stroma in which are formed the follicular elements of the ovary. The stroma is made of spindle-celled connective tissue cells, placed very compactly. There is only slight superficial condensation of this connective tissue called the *TUNICA ALBUGINEA*.

The primordial follicles found in such large numbers in the cortex consist of a central germ cell or ovum encircled by a flattened or low cuboidal layer of epithelium which constitutes the follicle epithelium or *membrana granulosa*.

The mature graafian follicle is a structure of variable size, though probably rarely exceeding 8 mm. in diameter. From without inward it shows the following elements:

- 1) *Theca externa*
- 2) *Theca interna*
- 3) *Membrana granulosa*
- 4) Germ cell area

The cell wall of the ovum is the vitelline membrane; its nucleus, the germinal vesicle, and its nucleolus the germinal spot. Very early in the history of the oogonia the tendency to concentrate effort on a few cells, rather than spread it over many, becomes apparent. The cells which lie adjacent to one of these growing oogonia arrange themselves as a protecting and food-purveying investment about the future ovum. The entire group of cells thus formed is known as a primary ovarian follicle. The ripe ovum is liberated from the surface of the ovary and following fertilization attaches itself to the viscera. Ordinarily only a single ovarian follicle is brought to maturity every four weeks. Following the rupture of the follicle and loss of the ovum the great bulk of the follicle cells and connective tissue theca surrounding the follicle become involved in the development of the corpus luteum (which becomes an organ of internal secretion).

The ovary is peculiar in that it represents two endocrine glands having their maximum activity at different times. The graafian follicles which produce one hormone, estrogen, are followed in the cycle by the corpus luteum which makes another, progesterone (Westman). The retrogressive phase of the corpus luteum has as

its end result the corpus albicans. The corpus luteum of pregnancy plays a very important part in the maintenance of pregnancy for a great majority of these cases of pregnancy will abort if the corpus luteum is removed, though rarely they do not.

Experimental work on the rabbit has demonstrated that the corpus luteum is essential to the maintenance of pregnancy during the first two or three months (Russ). The pregnant rat, mouse or rabbit almost invariably aborts after castration. Most authorities agree that the placenta takes over the function of the ovaries after the third month.

The frequency with which signs of ovarian insufficiency were associated with ovarian pain was sufficient to make them feel that ovarian pain was definitely caused by insufficient amount of ovarian hormones. In a study of 89 cases in which irregular menstruation, flooding, and pain in the left ovary followed removal of the ovary at the time of appendectomy, ovarian insufficiency and pain following loss of ovarian tissue was mentioned frequently in Heckel's group. The pain was relieved by estrogen in most of the cases tried, 10 out of 11 (Heckel). Many women suffer no ill effects from unilateral castration but there are others in whom there appear signs of ovarian failure. This can be accounted for when we realize that the ovary has at least 7 functions:

- 1) It produces fertilizable ova.
- 2) It governs menstruation.
- 3) It plays a large part in developing female physical and psychologic characteristics.
- 4) It exercises strong influence on sex-sense.
- 5) It promotes nidation of the ovum.
- 6) It is largely responsible for changes the breasts undergo during pregnancy.
- 7) It is a factor in the control of the nervous or vasomotor systems.

Some of these functions may reside in one ovary and some in the other, so if one ovary is removed entirely it may completely destroy one or more of the functions residing in that particular ovary. It is not realized many times the amount of ovarian tissue that can be removed without disturbing some of these very essential functions.

In Westman's experiments when all but one of the graafian follicles were destroyed, ovulation did not occur in that one even in the presence of sufficient quantity of gonadotropin hormone but when estrogen was added ovulation occurred and a corpus luteum was formed.

The ovary is subject to attack by such organisms as the gonococcus, the streptococcus, and the tubercle bacillus. The colon bacillus may be a primary or secondary invader. In the overwhelming majority of cases inflammatory lesions of the ovary are secondary to inflammation of the tube with which the ovary is in such intimate contact.

Abscess of the ovary may be encountered in either the acute or chronic forms especially common in association with the later stages of tuberculosis of the tubes.

Classification of Ovarian Tumors (Novak):

BENIGN TUMORS OF THE OVARY

(A) *Cystic*

(a) Non-Neoplastic

- (1) Follicle cysts
- (2) Lutein cysts (corpus lutein, corpus albicans, theca lutein)
- (3) Germinal inclusion cysts
- (4) Endometrial cysts

(b) Neoplastic

(1) *Cystadenoma*

- (a) Pseudomucinous (simple and papillary)
- (b) Serous (simple and papillary)

(2) *Solid Tumors*

- (a) Papilloma, fibro-adenoma, fibroma, fibromyoma, angioma, lymphangioma, chondroma, osteoma
- (b) Brenner tumors
- (c) Adrenal tumors (masculiniovablastoma)

MALIGNANT TUMORS

(A) *Carcinoma*

(1) Primary Solid Carcinoma

- (a) Adenocarcinoma (papillary and non-papillary)
- (b) Medullary carcinoma
- (c) Carcinoma simplex
- (d) Scirrhus carcinoma
- (e) Alveolar carcinoma
- (f) Plexiform carcinoma
- (g) Mesonephroma (not clearly established as yet)
- (h) Embryonic or dysontogenic (granulosa cell carcinoma, often cystic), thecoma, luteoma, arrhenoblastoma, dysgerminoma (seminoma).
- (i) Chorionepithelioma

(2) Cystic Carcinoma

- (a) Pseudomucinous cystadenocarcinoma
- (b) Serous papillary cystadenocarcinoma
- (c) Epidermoid carcinoma arising in dermoid cyst

(3) Metastatic Carcinoma

- (a) Adenocarcinoma, simple
- (b) Krukenberg tumor

- (c) Epidermoid carcinoma
- (d) Chorionepithelium
- (e) Hypernephroma

C. *Teratoma* (including struma ovarii)

D. *Sarcoma* (round cell, spindle cell, mixed cell).

E. *Melanoma*

The most frequent but from a practical standpoint the least important variety of ovarian cyst is that arising from the blighting of the ovarian follicles through the process of atresia folliculi. While the microscopic diagnosis of follicular cysts is usually easy, there may be occasional difficulty in differentiating from those of larger size in which a single layer of cuboidal or low columnar epithelium line the cyst wall. This cyst would come under the classification of the non-neoplastic type.

In the lutein cyst it should be remembered that both the granulosa and the thecal cells are capable of undergoing luteinization under the influence of the luteinizing gonadotropic hormone of the anterior lobe.

The corpus luteum cysts may be of various types: 1) cystic but normally functioning corpora lutea of menstruation or of pregnancy, 2) cystic corpora lutea in which overdistention is associated with cessation or disorder of function, 3) corpus luteum cysts resulting from partial or complete resorption of the blood elements in corpus luteum hematomas, the contents being clear or hemorrhagic to various degrees and the function being sometimes regained, sometimes not, 4) corpus albicans cysts arising in either of the two ways above described.

The germinal inclusion cysts are of no clinical importance as they are always very tiny, most frequently of microscopic size.

Cystadenoma of the Ovary: With this we have to deal with cysts which are of a generously proliferative neoplastic type. They indicate the more common variety of the ovarian neoplasm. Of these we have, 1) the pseudomucinous or pseudomyxomatous cystadenoma which may become very large in size and occasionally malignant; it is estimated that 5 per cent of this type show a malignancy at one time or another. This is the type that is seen (by the surgeon) which fills the whole abdominal cavity frequently, and may be multilocular with a mucinous-appearing material present. As contrasted with the serous cystadenoma, papillary growths in the wall of the cyst are infrequent, occurring in only about 10 per cent of the pseudomucinous tumors.

Malignant degeneration of primarily benign pseudomucinous

cysts may occur though this is rather uncommon, about 5 per cent according to the collected statistics of Meyer.

Pseudomyxoma peritonei, cysts of the pseudomucinous variety may occasionally perforate spontaneously, in which case there is danger of implantation of pseudomucinous epithelium upon the peritoneum. Such transplanted cells may continue their secretory activity, with the gradual accumulation in the peritoneal cavity.

The designation of "serous" as applied to the second great group of ovarian cystadenomas, is based upon the fact that the cystic fluid is rich in serum proteins, serum albumin and serum globulin. However, as in the case of the pseudomucinous variety, the laboratory diagnosis is made on the character of the epithelium and on certain characteristics of the growth pattern. The gross appearance may be about the same, and the consistency of the fluid content is an unsafe criterion. There is much more of a variety in the gross appearance of the serous cyst than in that of the pseudomucinous.

On microscopic examination the epithelium which characterizes the serous cystadenomas is far more variable than the usually very typical epithelium of the pseudomucinous variety.

The papillary structure of many of these tumors is, from a histologic standpoint, a very frankly benign one, with no suggestion of overactivity in the epithelium and with a sharp demarcation between it and the stroma, in spite of the fact that the latter is thrown up into arborescent projections which may become quite intricate.

When, instead of a single layer of uniform epithelium one finds two or more layers in some places, with perhaps only an occasional mitosis, and very little hyperchromatosis, it is difficult to determine or differentiate for in a very frankly benign papillary serous cystadenoma there can be no certainty as to a benign clinical course.

Histogenesis: There can be no doubt that the origin of serous cystadenoma is from the germinal epithelium of the ovary. The chief evidence for this statement is that all possible gradations can be demonstrated, from simple invagination of the germinal epithelium to the fully formed serous papillary cystadenoma.

Primary Carcinoma of the Ovary: The ovary is a striking exception to the old dictum of Virchow that organs which are frequently the seat of primary cancer are rarely involved in secondary malignancy, and vice versa. Both primary and secondary carcinomas of the ovary are relatively frequent, this organ ranking second only to the uterus as the seat of cancer in the female reproductive organs. Carcinoma of the ovary may be present as a solid or a cystic tumor, the latter being the more common in a proportion of 205 to 139,

on the basis of a summation by Meyer of several large series of reported cases. The same author found, in an even larger group of collected cases, that 50.5 per cent were bilateral (Novak).

While many subdivisions of the solid primary carcinomas have been made on the basis of microscopic structure, these all present numerous common gross characteristics, so that the latter may be described collectively.

The size of these neoplasms is extremely variable, some being very tiny and others weighing many pounds. The shape of the tumor may be round or ovoid, but in certain forms tends to be somewhat kidney-shaped. On cross section the color is seen to be usually gray or grayish pink.

The classification of solid primary ovarian cancer is notoriously unsatisfactory. Novak discusses these tumors as the chief forms of solid primary ovarian cancer and may be discussed as 1) Adenocarcinoma, 2) Medullary carcinoma, 3) Carcinoma simplex, 4) Scirrhus carcinoma, 5) Alveolar carcinoma and 6) Plexiform carcinoma.

Adenocarcinoma is the most common form of primary solid ovarian cancer. It occurs in a papillary and a nonpapillary form, the latter being the more common.

The Medullary Carcinoma: The special characteristic which distinguishes this group is the overwhelming preponderance of epithelium over connective tissue. Large fields of epithelial cells, showing the characteristic malignant changes, are seen. The cancer simplex on general pathologic grounds is given to that variety in which the epithelial and stromal elements are fairly evenly balanced.

In the scirrhus carcinoma the connective tissue is present in far larger amount than the epithelium, the latter occurring in the form of narrow columns or nests of cells which give the impression of being squeezed by the surrounding connective tissue.

Alveolar Carcinoma: As the name indicates, the epithelial cells in this group are arranged in alveolar groups, separated by areas of connective tissue.

Plexiform Carcinoma: In this form, which is not easy always to separate from the scirrhus, the epithelium is disposed in narrow columns or cords, which often anastomose.

In the discussion of the primary cystic ovarian carcinoma, Meyer has suggested that they be discussed under three heads, as follows: 1) Carcinoma arising in pseudomucinous cystadenoma, 2) Carcinoma arising in serous cystadenoma, 3) Carcinoma arising in dermoid cysts.

EXTENSION AND METASTASIS OF OVARIAN CARCINOMA

The coexistence of ovarian and uterine adenocarcinoma is not at all infrequent, and it is not always easy to be sure which organ has been the primary seat of the cancer, though most often it is the uterus, chiefly because of the much greater frequency of uterine cancer.

The tube is not infrequently secondarily involved in ovarian cancer.

The other ovary is involved in more than one-half the cases. There is no unanimity of opinion as to the cause of this frequent bilaterality of the disease.

Perhaps the most common secondary involvement is that of the visceral or parietal peritoneum. Pfannenstiel found peritoneal involvement in as many as 81 of 95 metastasizing ovarian cancers (85 per cent).

In a very large proportion of cases, especially in the later stages, the lymphatic glands show metastases. As with carcinoma of the fundus and tube, the lumbar group are apt to be first involved, though any or all of the retroperitoneal group may be attacked, and later even such distant groups as the inguinal and mediastinal.

Among the distant organs which may be involved with ovarian carcinoma are the liver, gallbladder, pancreas, the gastrointestinal tract, lungs, pleura, ribs and occasionally the long bones.

Metastatic ovarian carcinoma: Adenocarcinoma of the uterine body is the most important form of pelvic carcinoma from the standpoint of the richness of lymphatic intercommunication of the pelvic organs.

Of the metastasis from gastrointestinal cancer we have the Krukenberg tumor.

Route of Dissemination to the Ovary: There are four possible routes to be considered:

- 1) Direct implantation on the ovarian surface of cancer cells transported by the peritoneal fluid from the primary lesion into the pelvis.
- 2) Transportation of cancer cells by the blood stream.
- 3) Lymphatic metastasis.
- 4) Extension of cancer by direct continuity from an adherent intestinal cancer.

Even very tiny lesions of the pylorus, not discoverable except on microscopic examination, have in some cases been associated with Krukenberg tumor of the ovary.

The lymphatic route is the most general way of metastases of cancer dissemination.

Brenner Tumors of the Ovary: In Brenner's original communication the tumor was confused with granulosa cell growths, and it was Robert Meyer who in 1932 sharply distinguished between the two. From a microscopic standpoint there are two essential constituents, namely the characteristic nests of epithelial cells and the fibromatous connective tissues groundwork surrounding the epithelial islands. Both of these must be present to justify the diagnosis of Brenner tumor. The Brenner neoplasm is to be looked upon as benign. Perhaps because of their earlier confusion with granulosa cell tumors.

It was of interest to note that the three cases reported by Brenner in his original paper of 1907 were all observed by him within a period of one and one-half years.

Brenner tumors of the ovary occur most frequently in women beyond the menopause, the usual statement being approximately correct, that more than 50 per cent occur beyond the age of fifty.

Dysgerminoma of the Ovary: The size of dysgerminomas varies between wide limits, some measuring only a few centimeters in diameter, others being so large as to fill the abdominal cavity. Characteristically they are surrounded by a smooth rather dense capsule, though the contour may be slightly nodular. The consistency of the tumor, which is essentially a solid one, has often been described as "doughy" but a better adjective would often be "rubbery."

There are few tumors of the ovary which present such distinctive histologic characteristics as does dysgerminoma. This applies to both the cell type and the general architecture of the tumor.

As to the malignancy of dysgerminoma in general, there can be no question, though there is much variation in individual cases. Taken as a group they are less malignant than the arrhenoblastomas.

These tumors are about a third as frequent as granulosa cell carcinoma, which in turn makes up about 10 per cent of all primary malignant ovarian tumors (Fauvet).

Dysgerminoma is preeminently a tumor of early life, thus justifying the appellation of "carcinoma puellarum."

As the cases have accumulated it has been more and more evident that a large proportion, much more than one-half, have occurred in ostensibly normal women.

GRANULOSA CELL CARCINOMA, THECOMA AND LUTEOMA (Feminizing Mesenchymomas of Ovary).

The prevailing concept is that championed by Robert Meyer, that they arise from nests of redundant granulosa cells (*granulosa-ballen*) left over in the process of follicle formation.

There are wide variations in size of the granulosa cell tumor. The smallest have been only a few millimeters in size, while others have been so large as almost to fill the abdominal cavity.

Thecoma tumors are commonly firm and fibrous in appearance and consistency though they may, like the granulosa variety, show a tendency to cystic degeneration. Microscopically they are described as distinguished especially by the "presence of bundles of broad spindle cells, epitheloid in appearance, distributed in an irregular interlacing manner throughout the tumor, separated by varying sized bands of connective tissue and often hyaline plaques."

LUTEINIZATION OF GRANULOSA CELL TUMORS AND LUTEOMA

Another interesting histologic characteristic of this tumor type is that the constituent granulosa or theca cells may at times undergo a transformation into what are evidently typical lutein cells. Novak believes that the commonest type of the poorly understood and much discussed luteoma of the ovary represents merely a luteinized granulosa cell tumor.

The granulosa cell carcinoma of the ovary may be considered a fairly common tumor, comprising probably about 10 per cent of all solid malignant ovarian neoplasms.

ARRHENOBLASTOMA OF OVARY, ADRENAL TUMORS OF OVARY, LUTEOMA (Masculinizing Tumors).

By contrast with the feminizing group of tumors, the masculinizing tumors, represented chiefly by arrhenoblastoma, are quite rare. The designation arrhenoblastoma was coined by Meyer for this group of ovarian tumors, which originate in certain male-directed cells persisting in the ovary from the early stages of gonadogenesis.

At one end of the scale is the highly differentiated tumor, originally described by Ludwig Pick (1905) and designated as testicular adenoma, in which the reproductive is the highly undifferentiated variety in which the histologic picture is essentially that of sarcoma, though usually meticulous examination will reveal clues to its probable histogenesis. Between those two groups of differentiated and undifferentiated arrhenoblastoma, all gradations may be encountered so that Meyer has distinguished an intermediate group in which such criteria as tubule formation and the occurrence of interstitial cells are developed to greater or less degree.

As encountered at operation, the arrhenoblastoma is generally of very moderate size, and may be very small but in at least a few of the recorded instances the tumor has been very large.

Arrhenoblastoma is characteristically a tumor of young women, the greatest incidence being in the decade between twenty and thirty.

It is difficult as yet to evaluate the question of the degree of malignancy of this tumor group, because of the fact that most cases have been reported rather promptly because of their rarity and their biologic interest, so that not sufficient time had elapsed to judge their ultimate course.

ADRENAL TUMORS OF OVARY AND LUTEOMA

Tumors of this type are very rare, and may be either benign or malignant. The whole question of adrenal tumors of the ovary, and particularly of their relationship with the so-called luteomas, is still in a confused state.

Aberrant adrenal tissue is not infrequently observed, such rests being especially frequent along the course of the ovarian or spermatic vessels.

The clinical importance of this adrenal type of tumor lies in the fact that it produces a syndrome of defeminizing and masculinization phenomena identical with that of arrhenoblastoma.

OTHER TUMORS OF THE OVARY (Fibroma, Dermoid Cyst, Teratoma, Sarcoma, etc.)

Benign Solid Tumors: Fibroma comes in this class which may become very large of a fibrous nature and may have a hydrothorax or frequently accompanied by ascites, as in Meigs syndrome.

Teratoma, Including Dermoid Cysts: These two tumors are properly considered together, the latter constituting only one variety, though by far the most frequent one, of the former.

While authors differ somewhat as to the basis of distinction between the two, the following generalizations seem to be justified, namely:

- 1) The dermoid is a cystic tumor, the teratoma a solid one, though it may show occasional small cystic areas.

- 2) The dermoid is characterized by a predominance of ectodermal elements, though mesodermal elements are usually also found, and occasionally even entodermal structures. The teratoma always shows a conglomeration of elements derived from all three germinal layers. It is evident, however, that no sharp dividing line can be drawn between the two tumors on this basis.

3) The dermoid cyst is a benign tumor, all the abnormal tissue elements being well differentiated. The teratoma is to be classed as a malignant one, the fetal elements being of undifferentiated type, and the clinical course being characterized by such malignant features as recurrence and metastasis, with death in a large proportion of cases.

Dermoid cysts: Dermoid cysts make up a considerable proportion, about 10 per cent of the cystic neoplasms of the ovary. About 25 per cent of dermoids are bilateral. While they may occur at any age, even in childhood, they are most common during reproductive life.

Solid Teratoma: Solid teratoma is far less common than the cystic dermoid. While it may occur at any age, it is proportionately more common in young individuals than is dermoid cyst. The tumor is usually of small or moderate size, but may occasionally reach large proportions.

The malignancy of these tumors has already been emphasized, and metastases are frequent, not only in the pelvic organs and peritoneum, but also in distant organs.

Struma Ovarii (Thyroid Tumor of Ovary): In the same way, thyroid tissue, which is a frequent constituent of teratoma, may overgrow all other elements, producing tumors, made up entirely or in large part of thyroid tissue. This, at any rate, is the generally accepted explanation of such tumors, which, however, are rather rare.

Sarcoma of Ovary: Sarcoma of the ovary is relatively rare, its incidence as compared to carcinoma being generally given as about 1 in 40. It may occur at any age, but it is to be noted that it has been frequently observed in children.

Mayo and Fauster in 1932 reviewed the cases in which ovarian tumors were found among young girls at the Mayo Clinic. Later Hubert recorded 175 cases in which solid and cystic tumors of the ovary were found among children up to 17 years of age. Of these, 60 were malignant (32 sarcomas; 28 carcinomas) and 115 benign (53 cysts, 39 dermoids, 19 cystadenomas, 4 hematomas). This suggests the seriousness of these cases in view of the large percentage of malignancies.

Sessums and Murphy believe that conservatism is the policy of choice because following its practice fewer patients developed symptoms after surgical menopause. Of this group, in 91 women subjected to hysterectomy conservatism was used, and 52 patients subjected to hysterectomy and bilateral oophorectomy were studied. It was found

that the surgical menopause occurred in more patients, took place sooner, and was more severe after hysterectomy with associated bilateral oophorectomy than when one or both ovaries were conserved. The surgical menopause after hysterectomy, with and without associated bilateral oophorectomy, still persisted in three fourths of the patients at the time of last observation. In the remaining one fourth the menopausal symptoms had been completed. Its duration was shorter after associated bilateral oophorectomy than after hysterectomy with ovarian conservation. I have concluded from this study that when hysterectomy is to be performed during the child-bearing period the best interest of the patient is guarded by conservative treatment of ovarian tissue.

Olshausen of Berlin stated in his monograph: "Never, no never, remove all of both ovaries." This might well ring continuously in most of our ears. If we surgeons and gynecologists were better gross pathologists we would probably be more conservative in removing ovaries in many instances.

Olshausen made the statement that a piece of ovarian tissue the size of a grain of corn would keep up the menstrual function. He says that in order that the integrity of the ovary be maintained enough of the endometrium must be preserved to insure the continuation of menstruation. All too frequently all of the endometrial tissue is removed.

Howard A. Kelly, commenting on oophorectomy, remarked: The surgeon must bear in mind that his relationship to his patient is not dissolved with the successful performance of an operation—and he must decide that the remote sequelae of operative interference may be even more distressing to the patient than the present pains since she might become disabled in most relations of life. Proper surgery depends upon the recognition that what were once considered diseases of the tubes and ovaries are in many instances no diseases at all.

Bonney, an ardent advocate of conservatism, states that "there is a pleasure, pride, and satisfaction in conservative operations which cannot be appreciated save by those who have performed them . . . but it requires of the surgeon that he should forego a procedure which achieves a striking result in a startlingly short time for one which, though it takes longer, has far greater appeal to the connoisseur."

CONCLUSIONS

1. All are "mosiacs" in inheritance; "like begets like" is a fundamental principle. Environment creates nothing but aids in developing what is inherited.

2. Almost the entire reproductive and urinary systems of both sexes are formed from the wolffian body.

3. The ovary is divided into two parts: 1) the cortex, 2) the medulla. It has two endocrine glands each having its maximum activity at different times.

4. The ovary has at least seven functions.

5. Classification of tumors of the ovary is difficult; the classification given by Novak is probably the most practical.

6. Diagnosis as to whether ovarian tumor is benign or malignant should be made; 50 per cent of solid tumors, or more, are malignant.

7. Pseudomucinous cystadenomas are very large; about 5 per cent become malignant. Serous cystadenomas 10 to 15 per cent are malignant.

8. Primary carcinoma is quite frequent.

9. Where there exists an ovarian cyst, cystectomy is the logical operation but conservative surgery should be practiced on ovaries wherever possible if there is no malignancy. A surgeon ought to understand the functions of the ovaries and preserve at least a portion of an ovary realizing that if the patient is of childbearing age such conservative action may allow her to have one or more children which is of inestimable joy to a family. The surgeon needs to realize his tremendous responsibility for the happiness and welfare of his patients and should exercise considerable imagination and sound judgment in cases of this type.

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RESULTS OF PREFRONTAL LEUKOTOMY AT THE SOUTH CAROLINA STATE HOSPITAL*

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PSYCHOSURGERY—operation upon the intact brain for the purpose of relieving mental abnormalities—was initiated by Burckhardt, of Switzerland, about fifty years ago. He was far ahead of his time. His pioneer work was put aside until neurosurgical technique and experimental studies on the frontal lobes of animals placed psychosurgery on a more scientific basis.

The father of modern psychosurgery is Egas Moniz, a Portuguese psychiatrist, whose first operation was performed in 1935. The first prefrontal leukotomy in the United States was performed in 1936 by Freeman and Watts. They have done most to popularize this procedure. The operation has now been performed many thousands of times and is being more widely used, as it is better understood. Much is still being learned concerning selection of cases, type of operation best suited for each particular case and the details of the postoperative rehabilitation program.

There are several different technics of psychosurgery for the relief of mental illnesses. All of these operations have fundamentally the same object in view, that is, disassociation of the emotions from abnormal ideas.

Emotion is represented in the patient by anger, fear, irritability, gaiety. Our emotions are primarily centered in and controlled through the various nuclei in the thalamus.

Abnormal Ideas are represented by disturbances of thinking, e.g., delusion and hallucination. A delusion is a false belief, e.g., ideas of being persecuted by others. Hallucinations are false ideas which arise within the mind itself, e.g., imaginary voices telling the patient to perform certain violent or distasteful acts or else accusing him of unpardonable sins. These disturbed ideas arise in the intellectual areas of the brain which are known to be located primarily in the cortex of the frontal lobes. These abnormal ideas are perpetuated and dominate the individual's entire thinking through a continuous outpouring of nervous energy from the thalamic nuclei.

The basic objective of psychosurgery is to interrupt this abnormal continuous exchange of nervous energy between the intellectual

*Read before the seventeenth annual Postgraduate Surgical Assembly of The South-eastern Surgical Congress, Biloxi, Miss., May 23-26, 1949.

areas and the emotional centers. The methods of psychosurgery in use today attack all of the theoretically susceptible areas:

- A. Direct attack on intellectual areas (the origin of ideas).
 1. Topectomy—Poole
 2. Lobectomy—Peyton
- B. Interruption of intercommunicating pathways between intellectual areas and emotional centers.
 3. Lobotomy or Leukotomy
 - a. Lateral approach—Freeman and Watts
 - b. Superior approach—Lyerly and Poppen
 - c. Transorbital route—Freeman
- C. Direct attack on centers of emotion.
 4. Thalamotomy—Spiegel and Wycis

The first prefrontal leukotomy performed at the South Carolina State Hospital was in May, 1947. Since that time we have performed the operation in 71 cases. For our report today we have selected the first 50 patients operated on by the Lyerly-Poppen, superior approach. This open operation was chosen because it permits the most radical leukotomy, which is indicated in chronic state hospital cases such as ours.

SELECTION OF PATIENTS FOR OPERATION

All of our patients had received adequate electroshock therapy. This is a nonsurgical procedure and is easily administered with minimum complications. In chronic patients electroshock acts as a prognostic test. Those patients showing even temporary improvement with shock are more likely to be benefited by operation. Our patients had received all of the available psychiatric and medical treatments for their mental illnesses, and had finally been abandoned as therapeutically hopeless.

In selecting the patient, the psychiatrist must ask himself: "What symptoms will be relieved and which symptoms will remain? Will this patient get anything more than institutional improvement?" Another very important question is: "What about the family of this patient? Will they accept him in the home and help him to make a satisfactory emotional readjustment?"

Freeman and Watts believe that the suitability of the patient for leukotomy depends upon the degree of emotional tension in response to his abnormal ideas. Expressed in lay terms, we expect considerable improvement in patients who are very agitated, pacing up and down the ward, who are anxious and have groundless fears of the future; or who exhibit aggressive and hostile tendencies. Spec-

tacular results may be expected in some of the obsessive compulsive neurotics. These are people who are filled with indecision or who act as a result of a compelling emotional force. Next to show improvement are those with paranoid reactions, especially when the patient is emotionally upset by his delusions.

Unpleasant traits of personality may be magnified by the operation; therefore it is important to have an appraisal of the patient's prepsychotic personality. The inactive, apathetic patient remains the same after operation. The psychopath, who tells lies, still tells lies after operation. Our experience confirms the observation of others that no patient is made worse by the operation.

Again I want to say that all of our patients resided in the so-called "back wards" of the hospital and were considered hopeless. Some of our patients had been in the hospital for 20 to 25 years, or an average of $6\frac{1}{2}$ years in the entire group. It is important to keep this in mind in evaluating the results to be presented. Most of these patients were operated on, not with the expectation of their being able to return to their former place in society, but to relieve their mental agony and suffering resulting from abnormal ideas and disordered thinking. As a secondary consideration, the hospital benefits. Money is saved because property is no longer destroyed, nor are the other patients endangered by one who was previously combative.

THE OPERATION

The operation we use is that popularized by Lyster and Poppen and is by the superior approach. The patients are anesthetized with pentothal. The skin incisions and one inch trephine holes are made about 3.5 cm. lateral to the midline on both sides and 4 cm. in front of the coronal suture. From this site one is able to undermine the frontal cortex or else cut far posteriorly, depending upon the psychiatrist's opinion as to the severity of the patient's illness. All white fibers in the chosen plane are severed under direct vision. During the operation there have been no difficulties with shock, anesthesia, hemorrhage, or obstructed airway. None of our patients suffered hemiplegia, aphasia or other neurologic signs suggestive of injury to an important vessel or area.

POSTOPERATIVE REHABILITATION

Experience has clearly shown that the education of the patient's family concerning the postoperative retraining of the patient is equally important as the careful selection of the patients for operation. Many of these patients are rather unpleasant to deal

with soon after operation. If the family is not prepared beforehand for the apathy, irritability, and lack of initiative, they will be disappointed and impatient and further impede his postoperative progress. In such cases they are likely to return the patient to the hospital quickly without an adequate trial at home.

The postoperative rehabilitation program should be planned in such a way that the patient's welfare and progress are a distinct challenge to the family. They must be made to feel that their rôle is of vital importance in this therapeutic endeavor. Many of our chronic patients had more or less lost their places in the family circle because of their long absence and it was impossible to obtain the family's interest and coöperation. Even if the relatives do express a strong desire to do "everything possible" for this type of patient and strongly urge operation, it does not necessarily mean that they will permanently accept in their midst an individual who no longer has his prepsychotic personality.

Immediately after operation these patients are confused and disoriented. Frequently they deny being operated on. They usually wet the bed for a short time. During this period, toilet training is about all that can be accomplished.

The most common characteristic of the postleukotomy patient is his tendency to simplify greatly his emotional reactions to his environment. He wishes to live on a more stereotyped, less exacting plane. He prefers the simple routine tasks and attempts to avoid all responsibility. His early postoperative behavior is reduced to a few simple patterns that require a minimum of selfdenial and selfrestraint. Frequently he will show a childish lack of respect for modesty and is quite indifferent to customary and acceptable social behavior.

It is therefore essential to begin the retraining therapy of these patients soon after operation and to continue it over a period of some months to get maximum improvement. The basis of this rehabilitation is repeated stimulation of the patient's interest and the provision of proper motivating factors. If left to himself unstimulated and unchallenged, the patient usually remains inactive and disinterested in his environment. If an uninviting or too difficult task is forced upon him, he will make no effort to solve the problem, but may become irritable, loud and possibly combative.

It is impossible to predict just how closely this postleukotomy patient may approach his prepsychotic personality. The family should be warned not to expect him to be the same person they knew prior to the onset of his illness. There must be love, affection and family pride in order to cope with the long drawn out period of

rehabilitation necessary to re-educate these patients toward their prepsychotic normal.

EVALUATION OF PREFRONTAL LEUKOTOMY IN FIFTY CHRONIC STATE HOSPITAL PSYCHOTICS

In considering our results the following criteria were used:

Markedly Improved: The patient able to go home and able to assume many of his responsibilities and capable of performing some useful occupation.

Improved: The patient helping with the ward duties and having been moved from a back ward to a quiet ward, taking an interest in his personal appearance and capable of going home under a certain amount of supervision.

Slightly Improved: The patient improved as regards hospital care—no longer destructive—able to stay around other patients with only occasional outbursts of aggressive behavior.

Unimproved: No change in the patient.

Fifty patients operated on by prefrontal leukotomy, superior approach, followed from six months to two years.

Markedly improved, 18

Improved, 16

Slightly improved, 5

Unimproved, 6

Died, 5 of which 3 were operative deaths

The following brief abstracts of a few cases will serve to help explain our criteria of results:

CASE 2: A white female, aged 44, had been given repeated electroshock treatments (150). Prior to operation, if electroshock treatments were discontinued, she would refuse to eat, become extremely agitated, show increased psychomotor activity and almost exhaust herself. She did well after operation and was allowed to go home in July, 1947. We received a letter from her recently in which she stated that she enjoys being at home and keeping house. According to her husband, she cooks and does most of her housework. She is interested in people and makes a pleasing appearance when she goes out visiting, but is careless about her appearance when only the family is around. She talks about trying out new recipes, but never seems to get around to cooking them. She is classified as *Markedly improved*.

CASE 23: A white female, aged 39, was very aggressive, required restraint and was given repeated treatment with electroshock. After operation she was paroled for 5 months but had to be returned to the hospital, as she refused to cooperate with the family. At present she stays on a quiet ward and goes to the sewing room every day. She is classified as *Improved*.

CASE 14: A white female, aged 41, had been confined to a room more or less constantly for 10 years. She was aggressive, combative and under delusional control. She refused to wear her clothing and tore her sheets and blankets into shreds. In the postoperative state, this patient now sleeps with seven other patients and wears her own clothes. She is too unstable to leave the disturbed ward, for at times when pressed too hard she shows some hostility. She is classified as *Slightly improved*.

CASE 15: A white female, aged 30, was operated on at the insistence of the father. She was one of two sisters in the hospital. This one had been hospitalized for a longer time, but was the poorer candidate for psychosurgery. Before operation, she was inactive, manneristic and indifferent. She made numerous bizarre statements in response to her hallucinations. Since operation practically no change can be detected. She remains on the same ward and is classified as *Unimproved*.

Let us consider one other case:

CASE 10: A white female, aged 51, had received 126 electroshock treatments over a period of one year. She was aggressive, resistive and required as many as 4 to 6 attendants to bathe and dress her. She often refused to eat. Shock treatments made her more easily controlled. She was operated on on July 22, 1947. The family have been requested on several occasions to take her home. Her sisters teach school and live in small apartments and have no place for her. She works daily on the surgical ward and is permitted to take the babies out in the sunshine alone. She is capable of working outside of the hospital and is classified as *Markedly improved*.

Operative Deaths: The first operative death was due to a pulmonary episode in which the patient died very suddenly on the fourth postoperative day. The autopsy was restricted to the head, which revealed no intracranial cause for death. The second and third operative deaths were due to infection. Of our first 19 patients, several developed infections which were finally traced to a defective autoclave. Since the installation of a new autoclave, we have not had any wound or brain infections. Our operative mortality compares very favorably with that reported in the literature except for the early deaths due to infection.

Two patients have died subsequently. One patient died six weeks after surgery from treatment for intestinal parasites. Another patient died at the time of a second operation.

Postoperative Hemorrhage: Most surgeons report hemorrhage as the chief cause of death from prefrontal leukotomy. We have had only one hemorrhage and attribute this low incidence to the open operation where the structures are perfectly visualized. This patient had a hemorrhage on one side that required reopening of the wound and evacuation of the clot the night of operation. She recovered and is now at home.

Postoperative Convulsions: Freeman reports 7 per cent of cases

having one or more convulsions after an uncomplicated leukotomy. After a long series of shock treatments, he states you may expect 20 per cent convulsions. If the leukotomy is complicated by hemorrhage, infection and excessive shock therapy, 30 per cent convulsions. The convulsions respond to medication and tend to disappear entirely.

The first convulsion in our series was reported one and a half years after we began this work. Only 3 patients have reported convulsions. This gives a percentage of 6 per cent.

Relapses: We reviewed our cases in February 1948, May 1948, February 1949 and May 1949. Every time the patients were reviewed, it was found that the percentage of good results had improved. These findings are interpreted as meaning that relapses are not common, but that with the passage of time, the patients may become progressively better.

DISCUSSION

It seems fair to compare these patients who have had a brain operation done to relieve intractable mental symptoms, with other patients who have had operations to relieve intractable physical symptoms. A patient who has a complete stenosis of the duodenum due to an ulcer would soon die without the benefit of surgery. A patient who has had a subtotal gastrectomy does not have a gastrointestinal tract which is as good as it was in a normal state. A patient who has a cancer on his arm and has an amputation of the arm to save his life is more handicapped than he was before he was diseased. These are examples of operation which sacrifice an organ, or a part, to benefit the whole organism. Prefrontal leukotomy is such an operation. A disturbed mental patient who has this operation is not as efficient an individual as he was prior to his mental illness.

CONCLUSIONS

In this paper we have presented the results of prefrontal leukotomy on 50 chronic psychotic patients. The average stay in the hospital was $6\frac{1}{2}$ years prior to operation.

Medical literature contains many reports of remarkable results with leukotomy in mental illnesses of shorter duration. Very little has been recorded of the effect of this operation on the more chronically ill. With this fact in mind the operation was performed to help bring some relief to the distress and suffering of those who were considered hopeless and abandoned to the "back wards" of a state hospital. We feel our efforts have been rewarded in some

measure and that similar patients should have the advantage of psychosurgery.

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DISSEMINATED CALCIFICATION OF THE PANCREAS

With Case Report

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As early as 1664 de Graaf in his *De succi pancreatici natura e usa* advanced the theory of calculi in the pancreas. Autopsy records of 1667 established the existence of pancreatic calculi in the gland. It was not until 1910 that Link¹ reported the first case of disseminated calcification of the pancreas. Since that time fewer than 50 cases have been reported.* Because of the confused concept of lithiasis, calculi, and disseminated calcification of the pancreas as found in the literature, I cannot be certain of the exact number of cases on record. (Chart I.)

DEFINITION

Disseminated calcification of the pancreas is perhaps the end stage of chronic sclerosing pancreatitis, and is characterized by the deposit of calcium in the cells of the parenchyma. Although pancreatic stones frequently occur concomitantly with this disease entity, there is a difference manifest in the method of deposit of calcium, and a clear definition of the two should be kept in mind when making reports. A stone occurs in a duct or in a cyst cavity, and may be removed as a unit from its resting place. In disseminated calcification of the pancreas, on the other hand, the chalky deposit of calcium is so intimate with the cells of the parenchyma that the surgeon is unable to remove it in toto. Instead, it breaks away in fine particles, leaving some clinging to the tissue. This process may occur throughout the entire pancreas, in which case it is generalized, or it may be limited to a region of the pancreas, such as the head, in which case it would be regional disseminated calcification of the pancreas.

ETIOLOGY

Because of the frequency with which pancreatitis precedes disseminated calcification of the pancreas, it is logical to discuss the etiology of the two conditions at the same time. They may be classified as due to:

*The present study is based on a review of 32 cases which were written in detail. This comprised all the cases up to 1946. There were other cases of calcification of the pancreas mentioned in the body of papers dealing with various types of pancreatitis.

Read before the seventeenth annual Postgraduate Surgical Assembly of The South-eastern Surgical Congress, Biloxi, Mississippi, May 23-26, 1949.

CHART I

| CASE NUMBER | DATE | SURGEON | SEX | AGE | X-RAY | EXPLORATION | ASTHMA | TUBERCULOSIS | DIABETIC | WOUNDS | APPENDICITIS | ALCOHOLIC | PANCREATITIS | CISTS | STONES IN DUCTS | DIAGNOSIS OF ULCER | LOSS OF WEIGHT | DIARRHEA | TEMPERATURE | EMACIATED | MALE | WAITING | JAUNDICE | IMPROVED | REMAINING ILL | DIED | CAUSE OF DEATH |
|-------------|------|------------------------|-----|-----|-------|-------------|--------|--------------|----------|--------|--------------|-----------|--------------|-------|-----------------|--------------------|----------------|----------|-------------|----------------|------|---------|----------|----------|---------------|------|---------------------------------------|
| 1 | 1911 | Link | F | 22 | | X | | | | - | | | X | | X | | X | - | - | | X | X | X | X | | | |
| 2 | 1922 | Wells | M | 32 | | | | X | X | | | X | X | | X | X | X | - | - | | X | X | - | | | X | (Epilapay) |
| 3 | 1935 | Faust | M | 45 | X | X | X | | | | | X | X | | X | X | X | - | - | | X | X | - | | | X | (Unfavorable Post-Op. Course) |
| 4 | 1935 | Chirney & Sawyer | M | 49 | X | | X | - | | | | | | | X | X | X | | | | | X | X | | | | |
| 5 | 1939 | Brook | M | 76 | X | | | | - | | | X | X | | X | | | | - | | | | X | X | | | |
| 6 | 1940 | Baling | M | 34 | | | | | - | X | X | X | X | | X | X | X | - | - | (Jaundice) | X | X | X | X | | | |
| 7 | 1940 | Abell | M | 36 | | | | | X | | | | X | | X | X | X | - | - | | X | X | X | | | X | (Infection from Hypodermic Injection) |
| 8 | 1941 | Thomson | F | 11 | | | | | X | | | | X | | X | | X | | | | | | | | | | |
| 9 | 1941 | Thomson | F | 37 | | | | X | | | | | X | | X | | X | | | | | | | | | | |
| 10 | 1941 | Thomson | M | 38 | | | | X | | | | | X | | X | | X | | | | | | | | | | |
| 11 | 1941 | Thomson | M | 99 | | | | | | | | X | X | | - | | | | | | | | | | | | |
| 12 | 1942 | Baling, Belling & Merz | M | 49 | | | | | - | | | X | X | | | X | X | X | | | | | | | | | |
| 13 | 1942 | Darling | F | 39 | | | | | | | X | X | X | | | | | | | | | | | | | | |
| 14 | 1942 | King & Buchheit | M | 35 | | | | X | X | X | X | X | X | | X | | X | - | - | | X | X | X | | | | |
| 15 | 1942 | K & M | F | 35 | | | | X | | | | X | X | | X | | X | | | (Pyelitis) | X | X | X | | | | |
| 16 | 1942 | K & M | F | 17 | | | | | X | | | | | | X | | X | | | (Tuberculosis) | X | X | X | | | | |
| 17 | 1942 | K & M | M | 43 | | | | | | | | X | X | | X | | | | | X | X | X | X | | | X | (Tuberculosis) |

CHART I (Continued)

| CASE NUMBER | DATE | SURGEON | SEX | AGE | X-RAY | EXPLANTATION OPER. TIME | AUTOPSY | TRAUMA | TUBERCULOSIS | DIABETIC | MURDER | APPENDICITIS | ALCOHOLIC | PANCREATITIS | CYSTS | STONES IN DUCTS | DIAGNOSIS OF ULCER | LOSS OF WEIGHT | DIARRHEA | TEMPERATURE | EMACIATED | MASTIA | VOMITING | JAUNDICE | IMPROVED | REMAINED ILL | DIED | CAUSE OF DEATH | |
|-------------|------|----------------------|-----|-----|-------|----------------------------|---------|--------------|--------------|----------|--------|--------------|-----------|--------------|-------|--------------------|-----------------------|-------------------|----------|-------------|-----------|--------|----------|----------|----------|-----------------|------|----------------------------------|-----------------------|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | 1943 | Pusternak | M | 57 | | | | | | X | | | X | | X | X | X | X | X | (Pneumonia) | X | | | | | | X | (Infect in Right Lung-Pneumonia) | |
| 19 | 1943 | Pusternak | M | 46 | | | | | X | X | | | | | X | X | X | X | X | | | X | | | | | X | (Pleurisy-Tuberculosis) | |
| 20 | 1943 | Pusternak | M | 56 | | | | | X | X | | | | | X | X | X | X | X | (Gangrene) | | X | X | X | | | X | (Gangrene) | |
| 21 | 1944 | Graney & Reddick | M | 39 | | | | X | X | | | X | | | | | X | X | X | - | | | X | X | | | | | |
| 22 | 1944 | Pusternak | M | 28 | X | X | | (1944) MX | - | - | | | XXX | X | X | X | X | X | X | - | | | | | X | | | | (No-Box Given) |
| 23 | 1945 | Sage | M | 35 | X | | | | | | X(-) | X | X | X | | ? | | | | | | | X | X | | | | | |
| 24 | 1946 | Comfort & Gambill | M | 54 | X | | | | X | | | | | X | | | | | | | | | | | | | | | |
| 25 | 1946 | C & G | F | 29 | X | | | | X | X | | | | | | | | | X | | | | | | | | | | |
| 26 | 1946 | C & G | M | 69 | X | | | | | X | | | | X | X | X | X | X | X | - | | | X | X | | | | | (Subcapsular Abscess) |
| 27 | 1946 | C & G | M | 36 | X | X | | | X | X | | | | X | X | - | | X | X | X | X | | X | X | | | | | |
| 28 | 1946 | C & G | M | 36 | X | X | | | X | X | | | | X | X | | | X | X | X | X | | X | X | | | | | |
| 29 | 1946 | Munn | M | 23 | X | | | | | X | | | | | | | | X | X | X | X | | X | X | | | | | |
| 30 | 1947 | Wicks & Smith | M | 33 | X | X | | | X | | | | X | X | X | X | X | X | X | X | X | | X | X | | | | | (Tuberculosis) |
| 31 | 1946 | Good | M | 38 | X | X | X | | | | | | X | X | X | X | X | X | X | X | X | | X | X | | | | | (Massive Hemorrhages) |
| 32 | 1947 | Good | F | 47 | X | X | | | | | | | X | | | | | X | X | X | X | | X | X | | | | | |
| 33 | 1947 | Good | M | 66 | X | | | | | | | | | | | | | | | | | | | | | | | | |
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No autopsy incidentally found

1. Infection
2. Chemical reaction
3. Mechanical obstruction
4. Trauma
5. Hyperparathyroidism?

Infection probably plays a minor rôle in the etiology of pancreatitis. According to Pasternack,² infection of the biliary tract, duodenum, and the stomach might spread to the pancreas by way of the lymphatics. The infection might also reach the pancreas by way of the blood stream. Virus infection, such as mumps and infectious hepatitis, is considered by some to be of importance. Infection as an etiologic factor in pancreatitis preceding disseminated calcification of the pancreas was rare.

A factor favoring a chemical irritant as an etiologic agent is a positive history of chronic alcoholism in a large number of cases. The process by which it acts is problematic. Doubilet and Mulholland³ lay considerable stress on a chain of events as follows: The alcoholic abstains from food for two or three days. During this time the gallbladder concentrates the bile salts; the sphincter of Oddi becomes spastic. The patient then eats a fatty or rich meal. The gallbladder contracts forcing the concentrated bile into the common duct. When the pressure of the bile in the common duct is unable to overcome the resistance of the sphincter of Oddi, it flows into the pancreatic duct, causing pancreatitis. This is a rational deduction. An alternative theory is that the alcohol-laden blood may cause injury directly or indirectly by causing a chemical change in the delicate acinar cells. In the cause of pancreatitis, the first theory may be of prime importance; however, in a detailed study of 32 cases of disseminated calcification of the pancreas, 17 (53 per cent) were chronic alcoholics. Of the 17 alcoholics, only 6 cases (35 per cent) showed evidence of pancreatitis. Therefore, 65 per cent of the alcoholics who developed disseminated calcification of the pancreas did not have clinical evidence of antecedent pancreatitis. For this reason, alcohol must exert its influence on the pancreas, in disseminated calcification of the pancreas at least, by some other method than by the presence of bile in the pancreatic duct system.

A more logical approach to the cause of pancreatitis is that of mechanical obstruction. Here, it is necessary for the pancreatic and biliary ducts to have a common passageway into the duodenum. The obstruction may be caused by a stone lodged in the ampulla, by sustained spasm of the sphincter of Oddi, by a duodenal diverticulum close to the papilla, and by a polyp in the ampulla. Unable to

escape into the duodenum, the bile finds its way up the main pancreatic duct and its tributaries. At times, the reaction to this influx of bile into the pancreas results in an attack of pancreatitis. The irritant is the bile salts which becomes toxic when alkalized by the pancreatic juice.

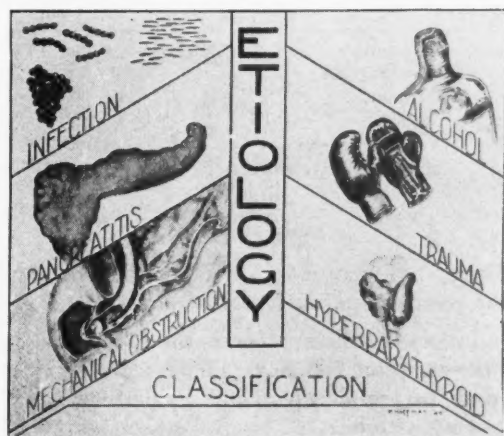


Fig. 1. Pictorial illustration of the etiology of disseminated calcification.

In the study of the 32 cases of disseminated calcification of the pancreas, there were 15 cases (43 per cent) with clinical manifestation of pancreatitis. Of these, only 7 cases (47 per cent) had jaundice. (There were 4 additional cases with history of jaundice who did not have a clinical history of pancreatitis.) Of the 32 cases, stone in the ampulla was not found in a single case. Consequently, I believe that prolonged sustained spasm of the sphincter of Oddi plays the most important part in mechanical obstruction as an etiologic factor in pancreatitis preceding disseminated calcification of the pancreas.

Regardless of the mode of injury, the process which takes place in the development of disseminated calcification of the pancreas is based upon a primary injury to a group of acinar cells. The injury is followed by the deposit of calcium carbonate in an effort to restrain or imprison the irritant and thus curtail further spread of the process, and to heal and repair the damage already done.

Trauma was sustained in 18 per cent of the cases of disseminated calcification of the pancreas.

Little evidence has been marshalled in favor of hyperparathy-

roidism as an etiologic factor. It is a possibility that must be considered.

TABLE I

Etiology

| | Per Cent |
|---------------------|----------|
| Alcoholism | 53 |
| Pancreatitis | 46 |
| Trauma | 18 |
| Mumps | 9 |
| Virus Hepatitis | ? |
| Hyperparathyroidism | ? |

SYMPTOMS

As in etiology, the symptoms and diagnosis of disseminated calcification of the pancreas parallel that of pancreatitis.

1. A vague digestive disturbance is the most common and most indefinite of the symptom complex. This is manifest by mild gaseous distention, mild postprandial pain and discomfort, and by an uneasy feeling in the epigastrium.

2. Pain is the most outstanding symptom, and occurs in 89 per cent of the cases of disseminated calcification of the pancreas. Irregularly occurring attacks of pain, constant and unyielding in quality, severe in intensity, prolonged at times to several hours, but occasionally highlighted with lancinating pain, causes the patient great agony. The suddenness of its onset often leads to the erroneous diagnosis of perforated peptic ulcer. Located primarily in the epigastrium, it radiates to the scapulas and spine, and fanwise over the abdomen. It is precipitated at times by little things, like a drink of water, and is not relieved by the average dose of sedative. At the end of an episode, the patient is left exhausted and nervous.

According to de Takats,⁴ pain is classified into two components: (1) visceral, and (2) somatic. The visceral component is due to direct or transmitted stimulation to the celiac ganglions, and is accompanied by girdle pain around the waist line and radiating fanwise to the lower abdomen. This type of pain is continuous, and shows intermittent lancinating exacerbation—not unlike those of tabetic crisis. The somatic component produces skin hyperesthesia in the appropriate segment, sensitivity of the spinous process of the segmental zone, and occasionally muscle rigidity. It results from the lesion extending to the peritoneum, where it irritates the somatic sensory fibers of the lower intercostal and upper lumbar nerves, or even the branches of the lumbosacral plexus.

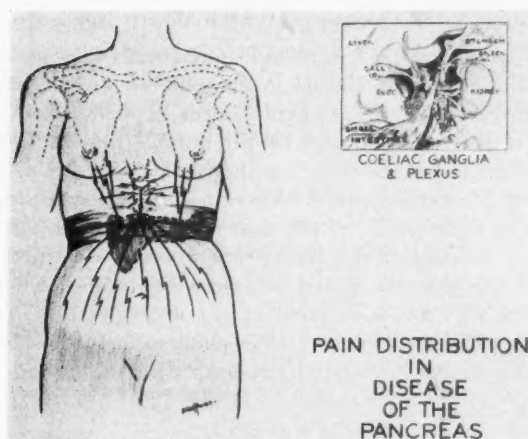


Fig. 2. Stimulation of the coeliac ganglion produces girdle pain about the waist line, which radiates to the spine, scapulas, and fanwise to the lower abdomen. Stimulation of the somatic sensory fibers of the lower thoracic and upper lumbar nerves produces hyperesthesia of the skin in the appropriate segment.

Nausea, vomiting, fever, diarrhea and jaundice may accompany an attack. Due to loss of appetite or fear of eating, the patient loses weight, slowly at first, but as the attacks get more frequent and more severe, emaciation develops.

TABLE II
Symptoms

| | Per Cent |
|---------------------|----------|
| Vague Indigestion | 90 |
| Pain | 89 |
| Nausea and Vomiting | 54 |
| Jaundice | 33 |
| Diarrhea | 30 |
| Fever | 30 |
| Emaciation | 27 |

DIAGNOSIS

Patients with a history of vague digestive disturbances which cannot be adequately accounted for, or patients with a history of pancreatitis, should make one suspicious of disseminated calcification of the pancreas. In addition to the tests for pancreatitis, a film of the abdomen should be made to show calcification of the pancreas, if present.

ASSOCIATED DISEASES

The following diseases were associated with disseminated calcification of the pancreas: Stones in the pancreatic duct, pancreatitis, diabetes, jaundice, diarrhea, peptic ulcer, appendicitis and tuberculosis. It is interesting to note that in only 20 per cent did diabetes and clinical pancreatitis occur in the same patient. Diabetes occurred in 50 per cent of the 18 cases with pancreatic stones. Pancreatic stones occurred in 64 per cent of the 14 cases with diabetes. This would indicate that greater fibrosis and destruction of the islands of Langerhans occurred in cases with stones in the pancreatic duct. Of the 11 cases with jaundice, 7, or 64 per cent, occurred in patients who also had stones in the pancreatic duct. Diarrhea occurred in 10 cases. Five of them, or 50 per cent, had pancreatic stones.

TABLE III
Associated Diseases

| | Per Cent |
|---------------------------|----------|
| Stone in Pancreatic Duct* | 55 |
| Pancreatitis** | 46 |
| Diabetes** | 42 |
| Jaundice*** | 33 |
| Diarrhea | 30 |
| Peptic Ulcer | 27 |
| Appendicitis | 27 |
| Tuberculosis | 15 |

*Pancreatic stones occurred in 64 per cent of the 14 cases of diabetes.

Of 18 cases with pancreatic stones, diabetes occurred in 9, or 50 per cent.

**In only 6 patients, 20 per cent, did diabetes and pancreatitis occur in the same patient.

***Of 11 cases with jaundice, 7 or 64 per cent, were found in cases with pancreatic stones.

TREATMENT

Doubtless there are many cases of disseminated calcification of the pancreas without clinical symptoms. I have 2 such cases. These need no treatment unless they indulge in alcohol and rich foods, which, then, should be restricted.

There are mild cases whose symptoms are chiefly those of digestive disturbances with episodes of severe pain. Antispasmodics, sedatives, proper diet, freedom from fatigue, and emotional upsets should be beneficial.

Other cases will have episodes of pronounced epigastric pain. It is assumed that there is obstruction of the common bile-pancreatic passage into the duodenum due to a stone, or more likely to a spasm of the sphincter of Oddi. Gastric acids increase the spasm, and fats cause the gallbladder to contract and empty against a sphincter that effectively closes the outlet. As a result there is pain from distention of the biliary duct and because of the bile which may be forced into the pancreatic ducts, an attack of pancreatitis may be precipitated. To avoid this, constant nasal suction should be instituted at once; nothing by mouth is given, intravenous fluids are administered, nitroglycerin, gr. 1/100, is given to relax the sphincter of Oddi, and demerol is prescribed to relieve pain. After 2 or 3 days the nasal tube may be removed, and frequent small feedings of a fat-free diet are prescribed.

A few patients will find it difficult to carry on their activities due to the severity and increasing frequency of the attacks. Here splanchnic block with novocaine is indicated. Not only may the pain be relieved, but also the abdominal distention may disappear. The duration of relief is about 6 months. If marked relief is gotten, sympathectomy should be done when symptoms recur.

In similar cases, one has the choice of recommending endocholechochal sphincterotomy—an operation devised and used successfully by Doubilet and Mulholland.³

The last and least indicated, and by far the most radical treatment, is that of pancreatectomy. It should be done only after failure of all other methods, and then only when the patient suffers long and intolerable pain. This procedure has been recommended by Whipple,⁵ when it is indicated.

When pancreatic cysts, jaundice, etc., complicate the findings, appropriate surgical procedures should be done.

PROGNOSIS

Apparently there are many cases free of symptoms. If the patient has not had bouts of pancreatitis, the outlook for remaining well is good. When the diagnosis is made early, and judicious treatment is followed, the patient may expect nothing worse than chronic indigestion with an occasional acute episode of discomfort. The more severe cases that require sympathectomy or destruction of the sphincter of Oddi may get relief of pain from these procedures. Sufficient time has not elapsed since the initial operation was performed to warrant an unqualified statement as to what the distant future holds for them. Temporary results are good.

The immediate mortality in pancreatectomy is fairly high, and

those who survive the operation very probably will be relieved of the intolerable pain; however, some invalidism will result.

Peterson and Cole⁶ have reported a case in which there was spontaneous absorption of the calcium deposits.

The case I wish to report is representative of disseminated calcification of the pancreas in its onset, development, complications, and severity of symptoms.

CASE REPORT

Mr. H., aged 36, first reported to the Southern Clinic on March 1, 1943, with a history of 5 severe attacks of epigastric pain since 1939. Examination at the Mayo Clinic had resulted in a diagnosis of duodenal ulcer. The patient followed the medical regime outlined for this condition. In 1940 an ischio-rectal abscess had been incised, and in 1941 a fistulectomy had been performed. On another date he was to have had an appendectomy, but it was not done because he developed severe convulsions when the anesthetic was started. In 1945 a renal stone was found in the upper calyx of the left kidney. At the same time a Graham Cole x-ray of the gallbladder showed a poorly functioning organ.

The patient was a chronic alcoholic and had received treatment for this. During the course of his illness he developed jaundice, accompanied by pruritis. It is significant that the patient had little, if any, fever with this. Cephalin cholesterol was 4 plus; icterus index 25; serum bilirubin 2.33 mg.; van den Berg delayed direct reaction; hypuric acid 1.72 mg.

Preoperative preparation of the patient consisted of administering of vitamin K, bilron, and several transfusions.

An exploratory operation was performed on Aug. 2, 1945. The abdomen was opened through an upper right transrectus incision. The gallbladder was markedly enlarged and distended. Its walls were thickened and somewhat reddened, but withal maintaining a normal bluish-gray appearance. No stones were palpated, either in the gallbladder or in the common duct. A scar was found on the anterior-superior surface of the duodenum just below the pylorus, but there was no pyloric obstruction. There was a large irregular mass in the head of the pancreas measuring approximately 7.5 cm. from the superior to inferior border, and approximately 5 cm. in the anteroposterior diameter. The mass was not stony hard as is usually found in carcinoma, but was definitely lobular on the surface of the pancreas. New adhesions were found between the duodenum and the pancreas and the duodenum and common duct. The pancreas was exposed by an incision through the gastrocolic omentum. It was almost milky in places, tending to the blue side. No evidence of pancreatic digestion was found. The liver was enlarged and showed evidence of biliary hepatitis. The appendix was small and retrocecal. The spleen was about two and one-half times its normal size and surrounded by adhesions. The stomach, intestines and kidneys felt normal. Since malignancy could not be definitely eliminated, a cholecystogastrostomy was done, and the appendectomy was performed.

His convalescence was smooth and he was dismissed from the hospital on August 11. Ten weeks from the date of operation epigastric pain reappeared. During the months of October and November he had attacks of pain every

3 to 5 days, while in December they increased in frequency, occurring as often as every 6 hours.

The patient reentered the hospital on Dec. 11, 1945. Admission notes stated: "After cholecystogastrostomy the jaundice cleared up and the patient gained weight. Pain in the epigastrium recurred in October at intervals much as before operation. They have become progressively worse and recently hypodermics have become necessary for relief of pain. The pain is usually a constant dead-ache in the epigastrium, with a mild griping element. He has vomited some and as long as 6 to 8 hours. There has been no recurrence of jaundice. Weight loss has been pronounced recently."



Fig. 3. X-ray shows extensive calcification of the head, and some deposit of calcium in the body and tail of the pancreas.

Physical examination: "Patient looks weak, ill, no jaundice; chest negative; peristaltic waves are easily visible over the epigastrium, undoubtedly in the stomach, occasionally with gurgling. Mass can be felt in the lower epigastrium."

X-ray reports on December 18 were as follows:

The preliminary film shows many areas of calcification in the head, and a few in the tail of the pancreas.

Chest: Negative.

Stomach: Negative.

Duodenum: Partial duodenal obstruction from extrinsic pressure; widened duodenal arch.

Diagnosis: Tumor of the head of the pancreas, with disseminated calcinosis, duodenal obstruction.

A second exploratory operation was done December 22. Examination of



Fig. 4. X-ray of the stomach showing areas of calcification in the head of the pancreas. Note the increased width of the duodenal arch.

the pancreas through an incision in the transverse gastrocolic omentum was done immediately. The organ was found to be enlarged to 4 or 5 times normal size and was firm in consistency. On aspiration two cysts containing clear fluid were found in the head of the pancreas. These were incised and explored with the examining finger. Each was about 4 by 7 cm. in size. No stones were found. The two cysts were converted into one and marsupialized.

The pathologic report of the biopsy of the pancreas was as follows: "Chronic sclerosing pancreatitis, non-specific etiology. No evidence of malignant disease."

For the first few days following the operation, the patient suffered with the same intense colicky pain in the epigastrium with which he suffered prior to the operation. After this the pain subsided. The attacks were far apart and when they came they were with less intensity. On Jan. 2, 1946, the following progress note was made: "Patient says he has not had any more severe colicky attacks of pain which characterized his illness prior to the operation." The maximum temperature was 102.6 on the fourth postoperative day; pulse rate was 122; respiration 26. There was a profuse drainage of clear fluid. He required about two hypodermics daily. He was free of fever December 26 and was dismissed on Jan. 5, 1946.

After returning home convalescence was uneventful for several days except for complaint of pain in the epigastrium. The wound continued to drain a considerable amount of clear fluid. It was thought that an addiction for morphine was the cause of his symptoms. A short time later he suddenly developed more severe pains, accompanied by nausea and vomiting. He was readmitted to the hospital for medical care on January 26. His general condition was poor. The fistula from the pancreas was still draining a white mucoid material.

Peristaltic waves were visible at times over the abdomen. X-ray examination revealed recurrence of partial duodenal obstruction from extrinsic pressure.



Fig. 5. Operative specimen. X-ray films show general disseminated calcification of the specimen.

The patient was given intravenous fluids, parenteral amino acids, amigen, and three transfusions while he was in the hospital. He was dismissed February 13. Under this management he gained weight. The nausea and vomiting had ceased, and the patient was able to be up and around. However, he continued to complain of pain periodically throughout the day, for which he received about four hypodermics daily. It was the consensus of the doctors attending him that he was undoubtedly becoming dependent upon morphine. For this reason the size and frequency of the dose were reduced.

The patient reentered the hospital March 17, with the following interval history: From February 13 to March 17 the patient was at his home with a practical nurse as a constant attendant. The clinical course was characterized by episodes of epigastric pain, aching of muscles and joints, the gradual loss of appetite and weight. The wound continued to drain a large amount of pancreatic juice; condition of the skin remained good. The patient became very despondent and threatened to take his life. After eating, an outline of the stomach with large peristaltic waves could be seen. At times he vomited. Because of the pyloric obstruction, he was sent to the hospital for further study. His general condition was about the same. He complained bitterly of epigastric pain. He was highly nervous, couldn't sleep, and was very despondent. He wanted to be kept asleep with drugs all the time. The laboratory reports were as follows: erythrocytes 4,220,000, leukocytes 9,000, hemoglobin 14.5 Gm., polymorphonuclears 66 per cent, lymphocytes 38 per cent; urinalysis negative.

X-ray report March 19 was: "Partial obstruction of the duodenum due to pressure from a pancreatic mass."

In view of the x-ray findings of partial obstruction of the duodenum due to a tumor in the head of the pancreas it was decided to reexplore the abdomen. At operation on March 21 the fistulous tract was carefully dissected. The head of the pancreas was explored, but no cyst was present. The original cysts were collapsed. The head of the pancreas was 2 to 3 times normal size, and

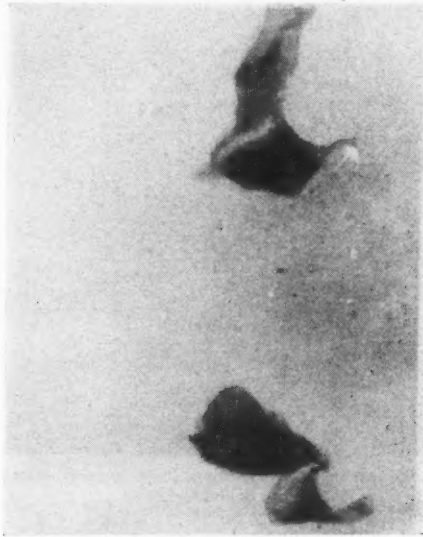


Fig. 6. Postmortem specimen. The portion of the pancreas left at operation was removed at postmortem. X-ray shows the absence of calcification.

the duodenal obstruction was due to the growth of solid pancreatic tissue. It was felt that the intolerable epigastric pain was due to the calcification of the pancreas. Three observations were made: (1) The entire pancreas was fairly mobile and could be lifted forward, giving excellent exposure; (2) The head of the pancreas involved with the mass lay considerably anterior to the coronal plane of the duodenum; and (3) A line of cleavage seemed to be present between this mass and a posterior layer.

Resection of this mass was begun and completed. It was separated from the duodenum and from the common duct posteriorly, and was severed from the body of the pancreas at the neck. The procedure was accomplished without injury to the duodenum and only one slight rent was made in the common duct. (Attachment of the anterior $\frac{1}{4}$ to $\frac{3}{8}$ inch of the duodenum is dense, after which the attachments are loose and are fairly easily dissected.) When this mass was removed, it left the body and tail of the pancreas dangling, and because of the calcification in this part of the gland it was decided to remove the body and tail (fig. 5). Only a small thin layer of the head posterior to the common bile duct was left (fig. 6).

He had a fairly stormy postoperative course (Table IV). The fever ran as high as 103, pulse 120, respiration 24. He was emotionally unstable and begged for hypodermics. There was considerable serosanguinous drainage, which gradually subsided. After 8 days he became optimistic and improved

TABLE IV
Postoperative Course and Treatment

| Date | Temp. | Glyco- suria | Blood Sugar | P-Z Units | Insulin Regular Units | Pan- creatin | REMARKS |
|---------|-------|-----------------|----------------|--------------|-----------------------------|------------------|---|
| 3-22-46 | 102 | 4+ | 270 | 10 | | Gr. 30 t.i.d. | Plasma. |
| 3-23-46 | 102 | 4+ | 270 | 10 | | " | Blood Transfusion. Cough. |
| 3-25-46 | 102 | 3+ | 242 | 10 | | " | Perspiring freely. Wound draining freely. |
| 3-27-46 | 102 | 3+ | 237 | 20 | | " | Greenish yellow drainage. Drowsy. Oral amino acids. |
| 3-29-46 | 102 | 4+ | 248 | 20 | | " | Penicillin. Blood transfusion. |
| 3-30-46 | 98.6 | 3+ | 221 | 30 | 10 | " | Drowsy. Cevalin. |
| 4- 2-46 | 100.2 | 3+ | 221 | 30 | 10 | " | Free drainage. Talking at random. Cevalin. |
| 4- 3-46 | 99 | 4+ | 242 | 30 | 10 | " | |
| 4- 5-46 | 99 | 1+ | 159 | 30 | 10 | " | Light diet. |
| 4- 9-46 | 98.4 | 1+ | 130 | 30 | 10 | " | |
| 4-11-46 | 98 | 1+ | 103 | 30 | 10 | " | Complains severe abdominal pain. |
| 4-14-49 | 98 | | | | | | Diarrhea. Dismissed. |

rather rapidly. Although he suffered from operative pain, the intense epigastric pain had subsided. He was controlled very well with insulin and pancreatin. (See chart.) He was dismissed from the hospital April 14, twenty three days after surgery.

The next day, following an enema, he passed some bright red blood. He also had a slightly bloody drainage on his dressings. The hemorrhages became more severe the following day, and he was readmitted to the hospital gravely ill. There was a slight icteric tinge to the skin, fever went to 104, pulse 116, respiration 24. He was dyspneic, had severe hiccoughs, vomited black blood, and had massive hemorrhages by bowel. Synkamin and bile salts were started. In spite of multiple transfusions, plasma and parenteral amino acids, the patient died rather suddenly from a massive hemorrhage while a transfusion was being started at 3:00 a.m. on April 17.

Permission for autopsy could not be obtained until after embalming had been done. The trochar had perforated the gastrointestinal tract throughout. No definite area of ulceration could be found. Blood was found in the stomach, duodenum, small and large bowel. Some blood was also found in the area from which the pancreas had been removed. The remaining portion of the

pancreas, a small bit lying posterior to the common duct, was removed for study. X-ray films were made of it. Calcification was not present (fig. 6).

COMMENTS

1. Disseminated calcification of the pancreas is a comparatively rare disease.

2. The etiology is closely related to chronic alcoholism and to pancreatitis.

3. There are no characteristic symptoms and signs diagnostic of the disease. Indefinite digestive disturbances and epigastric pain should prompt one to make a thorough study to determine if the pancreas is involved. X-ray films of the abdomen will reveal calcified areas in the pancreas.

4. Treatment in the mild cases is prophylactic, supportive, and by antispasmodics. Cases of moderate severity are treated by splanchnic block and sympathectomy, or by destruction of the sphincter of Oddi. The most profoundly affected cases may require pancreatectomy.

5. A case is reported of a chronic alcoholic, with episodes of pancreatitis complicated by jaundice and pancreatic cysts, who was treated finally by an almost complete pancreatectomy. He recovered sufficiently to return home. Shortly thereafter he died from unexplained massive gastrointestinal hemorrhages.

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*Used for statistical purposes.

The Southern Surgeon

Published Monthly by

The SOUTHERN SURGEON PUBLISHING COMPANY

701 Hurt Building

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Subscription in the United States, \$5.00

Vol. XV, No. 11

November, 1949

SURGICAL SHOCK*

WHEN one discusses the subject of shock with medical students and even with experienced surgeons, an attitude of complete bewilderment is occasionally encountered. This confusion is probably due to the multitude of conditions to which the term "shock" is applied and to the many seemingly conflicting experimental reports that continue to appear in the literature. The term surgical shock is used to describe circulatory failure that occurs with many conditions; hemorrhage, trauma, tension pneumothorax, spinal anesthesia, acute infections or combinations of these.

A review of the surgical deaths during the past 5 years at Jefferson Davis and Hermann Hospitals in Houston, Texas, reveals that of a total of 506 deaths, 108 could be classed as due to shock. The causative agents and number of each were as follows:

| | |
|--|----|
| (1) Hemorrhage | 7 |
| (2) Trauma | 1 |
| (3) Hemorrhage and trauma | 40 |
| (4) Hemorrhage, trauma, and contamination | 24 |
| (5) Hemorrhage, trauma, cardiorespiratory embarrassment and contamination or sepsis | 10 |

*From the Department of Surgery, Baylor University, College of Medicine, Houston, Texas.

| | |
|--|----|
| (6) Hemorrhage, trauma and cardiorespiratory embarrassment | 16 |
| (7) Sepsis | 6 |
| (8) Burns | 4 |

The distribution of these cases should agree with the experience of most clinicians, and serves to illustrate the fact that death from shock in patients is often caused by several agents and that the pure traumatic or hemorrhagic shock on which most of the experimental observations are based is not commonly found in clinical practice. Cournand et al,¹ from a study of shock in humans, and Wiggers,² from experimental investigations on animals, found that shock from trauma and hemorrhage were very similar. The anatomic factor immediately responsible for this type of shock appears to be a reduction in blood volume. The treatment of shock from trauma and hemorrhage then should be directed at restoration of the blood volume by transfusions of whole blood. The blood volume deficit should be corrected as soon as possible because if not corrected early the patient may not respond to treatment. This has been called irreversible shock and, though this is not a good term for it, it does serve to emphasize the fact that to be successful, treatment must be begun early. The pathologic physiology that causes this failure to respond to treatment in late cases is not well understood, but is probably due to some irreparable damage to vital organs.

The shock from burns is also due to a reduction in blood volume and although more plasma than cells is lost, there is some reduction in the red blood cells that must also be replaced. The same general rules apply here to early therapy.

The shock associated with cardiorespiratory embarrassment is often due to tension pneumothorax or cardiac tamponade. These conditions are best treated by decompression of the pleural or pericardial cavities; however, they were always associated with trauma, hemorrhage, contamination or sepsis in our cases so that physiologic derangements caused by these conditions must also be treated.

The shock associated with gross contamination or sepsis has been shown by Elbert and Stead³ to be due to a generalized circulatory failure presumably caused by the action of bacteria toxins on the blood vessels. The treatment then should be control of the infection. This type of shock is occasionally encountered several days after surgery from overwhelming peritonitis; however, it was more often a shock-producing factor associated with hemorrhage, trauma or cardiorespiratory embarrassment in our cases. When several of these lethal agents are associated to produce shock in one patient, one treatment may be overemphasized at the expense of others.

This too frequently leads to disaster, and can only be avoided by frequent painstaking reevaluation of the response to therapy.

The term chronic shock has recently been introduced to describe the syndrome of chronic illness associated with a low protein reserve, low blood volume and weight loss. A review of our cases reveals that in only 20 instances was this a contributing factor. Due to the discrepancy between blood counts, hematocrits, and blood volumes, we have found that the clinical picture of the condition described as chronic shock is much more reliable than any of the laboratory diagnostic procedures.

Other important measures that aid in the treatment of shock are prevention of further trauma, relief of pain, maintenance of an open airway and prevention of overheating. No known drugs or hormones have so far shown any definite benefit in shock and some, such as adrenalin, may actually be harmful. The chief objection to these agents is that they consume the attendants' time and in institutions where they are used it has been my observation that other more physiologic measures such as transfusions have frequently been neglected.

Although we do not understand some of the pathogenesis of shock and the causes of irreversible shock, enough is known of the etiology and anatomic changes to permit successful therapy in most cases if these known facts are kept in mind.

ELLIOTT B. HAY, M.D.

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BOOK REVIEWS

The Editors of THE SOUTHERN SURGEON will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.

OPERATIVE SURGERY. By FREDERICK C. HILL, M.D. New York: Oxford University Press. Price, \$12.75. 1949.

The author with his extensive background of teaching experience has consolidated and tabulated a digest of old and new knowledge into a volume which is easily read and understood. Each general surgical subject is carefully covered with a short note on preoperative treatment followed by a description of the gross lesion concerned, then there is a somewhat detailed description of the operative procedure, and there are usually a few notes on postoperative treatment.

This should be a good book for the medical student or surgical intern (to whom it is directed) to use to freshen up on the operative procedures that he is scheduled to assist. Indeed the chapter on General Principles is excellent in its practical instruction to the assistant. There are several places where one notes the same difficulty found in most single author texts—the problem of getting the whole book written in a short enough period of time so that the first written doesn't become out of date. Examples of this are found in mentioning thiouracil but not propylthiouracil in the goiter section and not mentioning portocaval shunt in connection with cirrhosis of the liver.

This volume should come to the attention of all surgical chiefs that they may place it in the dressing room of the operating suite for their internes' reference and preoperation reading.

A. H. L.

UROLOGICAL ASPECTS OF SPINAL CORD INJURIES. By GEORGE C. PRATHER, M.D. Price, \$3.75. Pp. 143, with 42 illustrations. Springfield, Ill.: Charles C Thomas, Publisher, 1949.

In this monograph, the author has clearly described the anatomy and the physiology of the urinary tract in health and in denervation. He has reviewed the various types of treatment used by others in the past with the results obtained, and compares them with the present ideas of neurosurgeons and urologists with their results. The complications and their treatment in the kidney and lower urinary tract are described and illustrated.

The author's wide experience in this subject has enabled him to prepare a monograph that should prove useful to those who see only an occasional patient with cord injury as well as those who see a number of cases each year.

A. H. L.

A COMPANION IN SURGICAL STUDIES. By IAN AIRD, M.D., Ch. Me. F.R.C.S. Pp. 1060. Price, \$15. Baltimore: The Williams & Wilkins Company, 1949.

Here is a different type of text, as the title states a companion to the usual surgical text. It is the result of the many years' postgraduate teaching during which the author realized that the student surgeon, to understand the pathologic basis of symptoms, the physiologic basis of treatment, and the reason

for divergence of the signs and symptoms of the individual patient from the classic clinical picture of the responsible disease, needed to have possession of certain basic and elementary facts. The author thus attempted to gather a canon of surgical knowledge to act as a springboard from which the student may project himself into the difficult realities of clinical surgery. This, in short, is a digest of the written word of others through the enzymes of personal experience.

The style is simple, straightforward; in fact, many times one feels that there is an oversimplification of the text. There is missing in many instances, in spite of the author's good intentions, the explanation of the reasons of the theories underlying the pathology of the disease and physiology of treatment. All orthopedic diseases are omitted. This is an interesting new type of book.

A. H. L.

OPERATIONS OF GENERAL SURGERY. By THOMAS G. ORR, M.D. 2d ed. Price, \$13.50. Pp. 892, with 1700 illustrations. Philadelphia: W. B. Saunders Company, 1949.

The author has revised his first edition into a very pleasing 892 page volume containing 1700 illustrations. The chapters on normal healing and the treatment of fresh wounds are very good. The subject matter is well covered in an easily understandable manner. In general, a short review of the anatomy is presented followed by a summary of the indications for the operation; there are a few important remarks on dangers and safeguards which precede a clear description and visualization of the steps in the operation. The chapters have been revised in systems rather than in strictly anatomic divisions. It is most unusual for a single author to write a book in which all chapters are up-to-date; usually when the last chapter is finished, the first written is antiquated, but not so in this volume. It is quite up to the moment. Here is another good addition to the library of the specialist, the surgeon, as well as the practitioner, who also does surgery.

A. H. L.

ABSTRACTS FROM CURRENT LITERATURE

INDICATIONS FOR AND RESULTS FOLLOWING EXPLORATION OF THE COMMON BILE DUCT FOR STONES. L. S. McKittrick and N. J. Wilson, *California Med.* 71:132-137 (Aug.) 1949.

This study, based upon 200 consecutive operations on the gallbladder or common duct for conditions other than carcinoma or stricture and 100 consecutive cases in which the common duct was opened and explored, seeks to define the indications for these operations and to analyze the end results.

"The objective of an operation on a patient with a surgical gallbladder is 1) to remove a lesion which is jeopardizing the patient's life; 2) to remove a potential hazard; or 3) to relieve the patient of symptoms.

"Specifically, operation is indicated for:

- 1) Definite recurrent attacks of pain which are typical of so-called gallstone colic when stones or abnormal function of the gallbladder are demonstrated by cystogram.
- 2) Symptoms coming in attacks which are suggestive, but not characteristic of gallstone attacks, when gastro-intestinal and other studies do not reveal an adequate cause and when the gallbladder does not fill after ingestion of the dye. In a doubtful case, the examination should be repeated.
- 3) Occasionally, in a patient with typical attacks of gallstone colic when the patient is seen in one of these attacks by his medical advisor, or by the surgeon and a definite diagnosis of gallstone colic is made, but where x-ray examination of the gallbladder in the standing as well as in the horizontal position shows a gallbladder which fills and empties normally without evidence of stones. Kidney and gastro-intestinal studies should be negative. This combination of findings is uncommon and therefore operations under these conditions should be done infrequently.
- 4) Gallstones with or without minor symptoms which have been definitely demonstrated in a patient who is a good surgical risk.
- 5) Recurrent attacks of chills and fever with or without pain and/or jaundice associated with abnormal cholecystogram (usually failure to fill) and no other demonstratable cause for the attacks.
- 6) Recurrent attacks of pain and/or jaundice, chills, and fever after cholecystectomy.
- 7) As an elective procedure following an attack of pancreatitis."

Among 100 consecutive patients who had removal or drainage of the gallbladder and exploration of the common duct for stones, there were no serious immediate or late complications and there were no operative deaths. Ninety-six of the 100 patients had stones either in the gallbladder or in the common duct or in both. Fifty-two had one or more stones in the common duct.

Ten patients later died of unrelated cause and six were lost to follow-up. Of the 84 patients whose present condition is known, 75 (or 89 per cent) have a completely satisfactory result. Six have minor residual symptoms (results classed as good) and in three the result is considered unsatisfactory. Cholangiograms taken before removal of the T tube showed residual stones in two patients. In each instance the stones were subsequently passed. Both of these patients are in excellent condition.

"While the dilated duct can be explored with a high degree of safety, this is not true of the duct of normal size. Every effort should be made to lessen the number of negative explorations."

TUMORS OF THE TESTICLE—RELATIONSHIP OF STRUCTURE TO COURSE AND PROGNOSIS. N. R. Wyndham, *J. Internat. Coll. Surgeons* 12:431-438 (July-Aug.) 1949.

This study, based on 41 cases of testicular tumor, most of which were under observation for four or more years unless death supervened, stresses the following points:

- 1) The outlook for seminoma is many times better than for teratoma.
- 2) For a tumor to be labeled a seminoma, it must have the characteristic uniform appearance described for such a tumor. Certain unicellular tumors exist which show much greater cellular variation than do seminomas and are not to be confused with seminomas. "We do not use the term 'embryonal carcinoma'—it infers more than can be proven."
- 3) Some of the most malignant tumors are included among the teratomas only on presumptive evidence. Elsewhere in the body they would be called adenocarcinoma. The syncytial masses of cells they contain signify rapidity of growth and are not necessarily characteristic of chorionepithelioma.
- 4) Hormonal tests are unreliable aids in differential diagnosis.

Of 17 teratomas, two occurred in the testicle retained in the abdomen. Two of 14 teratomas were found in testicles situated in the groin as was one of seven adenocarcinomas. Altogether five of 41 malignancies occurred in maldescended testicles. No definite evidence could be found to prove trauma to be the actual cause of a tumor. Eight cases were at first erroneously supposed to be inflammatory. This error occurred most frequently in seminoma.

INTUSSUSCEPTION IN INFANTS AND CHILDREN. *A Report of 143 Consecutive Cases.* W. H. Snyder, A. R. Kraus and L. Chaffin, *Ann. Surg.* 130:200-210 (Aug.) 1949.

In 143 consecutive cases of infants and children whose signs and symptoms were sufficiently suggestive of acute intussusception to lead to the final diagnosis, there were 7 deaths, or a mortality of 4.8 per cent. Of these 143 patients, 125 were operated on and 18 were treated conservatively. In the operated group there were 5 deaths, or a mortality of 4 per cent. In two patients who were admitted in moribund condition the diagnosis was missed and death occurred. Two cases diagnosed as intussusception were submitted to laparotomy and no intussusception was found. Both of these patients recovered. Five of the seven fatal cases had had symptoms for three days or longer at the time of admission. One other case was complicated by acute lymphogenous leukemia.

The authors attribute these excellent results to: 1) early diagnosis by an alert pediatric staff; 2) general agreement that surgery is indicated as soon as the diagnosis has been made and the patient prepared; 3) proper preparation and aftercare with suction, fluid, electrolytes, blood and antibiotics.

At operation, 1 Gm. of streptomycin in 3 c.c. of saline is injected with a fine gauge needle into the bowel proximal to the intussusception in all cases with 1) a preceding history of diarrhea before the onset of the symptoms of intussusception, and 2) whenever there is severe damage to the intussusceptum,

regardless of whether or not this requires resection. The authors feel that this is an important supplement to the parenteral administration of antibiotics in avoiding local and generalized infections.

VOLVULUS OF THE MIDGUT. M. R. MacCharles and C. W. Clark, *J. Internat. Coll. Surgeons* 12:489-496 (July-Aug.) 1949.

Though the foregut and hindgut are practically immune to anomalies of disposition, the midgut undergoes a rather complicated series of maneuvers before it finally arrives at what we consider to be its normal anatomic position and as a result congenital defect indisposition of the midgut is occasionally encountered as a cause of intestinal obstruction.

Two types of anomaly must be kept clearly in mind if this problem is to be approached intelligently. First, failure of rotation, either partial or complete ("non-descent") and secondly, the failure of fixation of the mesentery. When the fixation of the mesentery is incomplete and the whole midgut is left hanging from a pedicle mainly consisting of the superior mesenteric vessels, it then runs the risk common to all pedunculated viscera, the threat of torsion. This may well be kept in mind when considering the problem of intestinal obstruction.

The authors present a lucid description of the mechanism of volvulus and a brief discussion of the signs, symptoms and treatment. Nine cases of volvulus of the midgut are presented. The patients range in age from two days to 52 years. It is emphasized that the condition may exist in the absence of distention and may occur at any age.

LATE RESULTS IN TREATMENT OF PANCREATIC CYSTS BY INTERNAL DRAINAGE. D. H. Poer and R. H. Stephenson, *Surg., Gynec. & Obst.* 89:257-263 (Sept.) 1949.

The authors, in support of their stated belief that internal drainage of pancreatic cysts is the treatment of choice when total excision is not easily accomplished, present three cases, two of which were successfully treated with internal drainage. These patients, one treated with cystogastrostomy and one with cystojejunostomy, were well and symptom-free eight and seven years respectively after operation. At last examination, each of these patients had normal pancreatic function, from both the digestive and endocrine aspects. Carefully conducted x-ray examinations failed to reveal any evidence of a persistent cyst or sinus.

In the opinion of the authors, cystojejunostomy is preferable to cystogastrostomy or cystocholecystostomy. It is emphasized that the anastomosis must be performed with at least two rows of nonabsorbable sutures and that the stoma so created must be at least 4 cm. in diameter.

In a discussion of the etiology, the frequency of trauma or of an antecedent pancreatitis is stressed.

THE STUDY OF MORTALITY IN A BURNS UNIT. J. P. Bull and J. R. Squire, *Ann. Surg.* 130:160-173 (Aug.) 1949.

In an effort to facilitate the comparison of the results of various methods of treatment of burns by various groups, the authors have devised a system of simple tables and graphs to indicate mortality rates for any age group and percentage of burned area determined by the application of the Probit analysis. A grid table is provided for making a simple comparative assessment of the results obtained in other series. It is to be hoped that this technic will be

applied to the study of conditions other than burns. A discussion concerning the likelihood of finding a "general law of ageing" is included.

The main features of the treatment employed in this series are:

- 1) Segregation and treatment of patients in a specially organized Burns Unit.
- 2) Adequate replacement of fluids by mouth and by vein.
- 3) The utmost precautions against added infection and, in particular, cross infection.
- 4) Local chemotherapy occasionally reinforced by general medication.
- 5) Skin grafting when required.
- 6) Generous dietary treatment.

The mortality findings among 794 burned patients treated in the Birmingham Accident Hospital (Birmingham, England) by a Burns Unit are reported.

PEPTIC ULCER FOLLOWING SPLANCHNICECTOMY. *A Report of Thirteen Cases.* S. C. Mason and H. M. Pollard, *Surg., Gynec. & Obst.* 89:281-284 (Sept.) 1949.

After a discussion of the subject of the precipitation of peptic ulceration in animals by splanchnicectomy, the authors present thirteen cases of peptic ulcer following this operation in human beings. These were of a series of 1,498 cases done in eleven years for hypertension. Three of the thirteen had proved ulcers preoperatively while in four a presumptive diagnosis of ulcer had been made. Three others had had symptoms suggestive of ulcer. Eleven of twelve ulcers which appeared after operation became complicated. Frequently, it was only by the complication that the ulcer announced its presence. Five of the eleven complicated cases had severe complications. Two of these were fatal and the other three required emergency laparotomy.

Though the authors could form no opinion as to whether splanchnicectomy itself caused the ulcers, they were clearly impressed that the frequent and severe complications were due to the abolished or diminished epigastric pain sensations allowing the ulcer to progress to an advanced degree without the usual warning. Patients with recently healed ulcers and especially patients with active ulcers developed complications most rapidly following observation.

The authors conclude that more attention should be paid to vague abdominal complaints following splanchnicectomy and that prompt investigation, diagnosis and rigid medical management would result in a decrease in the frequency of complication.

THE SIGNIFICANCE OF AN ULCERATING LESION IN THE STOMACH FOLLOWING GASTROENTEROSTOMY. H. K. Gray and K. A. Lofgren, *Surg., Gynec. & Obst.* 89:285-291 (Sept.) 1949.

In reviewing 53 cases of ulcerative gastric lesions following gastroenterostomy, the authors feel that they have confirmed their feeling that such lesions show a high incidence of malignancy. Of these 53 cases, 18 or 34 per cent, had malignant lesions of the stomach requiring subsequent gastric resection. Of the 41 patients who had gastroenterostomy for duodenal ulcer, 11 experienced malignant lesions as later demonstrated by operation. Five of the 11 patients gave a history typical of benign ulceration and in four appreciable quantities of hydrochloric acid were found on gastric analysis.

Roentgenologic diagnosis is difficult at best and is almost impossible when the new lesion is distal to the old gastroenterostomy stoma. The authors em-

phasize the importance of suspecting and ruling out carcinoma before instituting conservative management of ulcerative lesions of the stomach following gastroenterostomy.

CANCER OF THE GALLBLADDER. *Report of a Five Year Cure of Anaplastic Carcinoma with Metastasis.* R. J. Booher and G. T. Pack, *Am. J. Surg.* 78:175-180 (Aug.) 1949.

Following a brief discussion of the incidence of carcinoma of the gallbladder and the resectability rates, the authors present a case report of a 63 year old female who at operation was found to have a tumor of the ampulla of the gallbladder with some fixation to the liver and with metastasis to a lymph node in the neighborhood of the foramen of Winslow. This proved to be a highly anaplastic adenocarcinoma (Grade III—Dr. Fred Stewart) and sections of the lymph node proved metastasis. The patient was treated by cholecystectomy and simple excision of the lymph node. This patient was free of symptoms and of roentgenologic evidence of recurrence almost eight years later.

The authors conclude that despite marked histologic malignancy and regional node metastasis, carcinoma of the gallbladder is sometimes curable and an attempt to control such a disease process is always in order.

CONGENITAL ANAL STRICTURE. J. Liburt, *J. Pediat.* 35:180-184 (Aug.) 1949.

No accurate statistics are available in regard to the occurrence of this deformity which, due to the lack of routine examination of the rectum at the time of delivery, may not come to the attention of the physician until it produces some marked impediment to alimentation. Since most infants cry, have colic, and are more or less troubled with loose stools, these things are for the most part accepted as normal by the parent. Thus the physician rarely sees the child until the condition becomes complicated by fissure or otherwise, and bleeding or other indication of trouble presents itself. Digital examination of the rectum will detect the stricture when present and proctoscopic examination will reveal the state of affairs. Fissure is often present. A fecal impaction may exist above the stricture.

When feasible, the stricture should be treated by dilatation and when this fails to give relief, a simple surgical procedure is described by the author which is said to be curative. This consists of simple multiple radial excision down to the external sphincter. This is followed by digital dilatations twice weekly until healed. Of 22 cases seen by the author in the past three years, 11 which proved to be resistant to conservative treatment were successfully treated by this method.

RECENT ADVANCE IN SURGERY OF THE COLON. B. M. Black, *Journal-Lancet* 59:275-278 (Aug.) 1949.

The essayist believes that the gratifying decrease that was noticed in 1939 and 1940 in the mortality rates of resection of any segment of the colon has been due to chemotherapy and has been followed by marked changes in colon surgery. Treatment of lesions of the right portion of the colon by one stage resection and ileocolostomy has become standard and the mortality rate has been diminished to 2 to 3 per cent. Lesions from the mid-transverse colon to the lower part of the sigmoid are now almost routinely treated by segmental resection and primary intraperitoneal anastomosis usually without a proximal

colostomy. Exteriorization still has a definite place in certain cases when inflammation, obstruction or unusual obesity are present. For lesions of the lower sigmoid, rectosigmoid and upper part of the rectum, proximal colostomy and segmental resection are usually employed. For certain upper rectal lesions, sphincter-saving operations are advocated while for more distal lesions, one-stage combined abdominoperineal resection remains the operation of choice. The mortality for the latter procedure remains at about 5 per cent while in segmental resection of more proximal segments it is approximately 3 per cent.

SAPHENOUS PHLEBECTOMY FOR VARICOSE VEINS DURING PREGNANCY. F. W. Peyton and F. A. Loop, *Am. J. Obst. & Gynec.* 58:318-325 (Aug.) 1949.

Dissatisfied with results with conservative procedures such as bandaging and complete rest and feeling that simple ligation and injection did not constitute definitive therapy, the authors began two years ago to employ segmental saphenous phlebectomy in the treatment of preexisting varicosities during the course of pregnancy and conclude that "Individualized radical surgical measures for preexisting varicose veins offer an opportunity for therapy in the pregnant woman at the time when it is needed most. It can be accomplished without and greater hazard than in the non-pregnant. . . . the results obtained justify continued consideration of saphenous phlebectomy during pregnancy."

PRIMARY EPITHELIOMA OF THE URETER. B. A. Smith, *Journal-Lancet* 49:233-236 (July) 1949.

With about 250 cases reported to date, primary ureteral neoplasm does not seem as rare as it was once considered, nor does the prognosis seem as grave. Prognosis depends upon the degree of malignancy and the extent of the lesion when treatment is instituted. A good ureterogram is essential for diagnosis and a hydroureter found at nephrectomy must be explained. Bleeding from the ureteral stump after nephrectomy should be considered pathognomonic.

One stage complete nephroureterectomy is the treatment of choice.

TOTAL PANCREATECTOMY FOR HYPERINSULINISM DUE TO ISLET-CELL ADENOMA: Follow-up Report Five and One-half Years After Operation, Including Metabolic Studies. J. T. Priestly, M. W. Comfort, and R. G. Sprague, *Ann. Surg.* 130:211-217 (Aug.) 1949.

In 1943, Rockey reported the first total pancreatectomy on a human being and this patient survived for 15 days following operation. By 1948, Gaston was able to collect data on 17 cases, seven of which survived the immediate postoperative period. So far as the authors have been able to determine, a case reported by Priestly, Comfort and Radcliffe in 1944 was the first to survive the immediate postoperative period. This same patient, who was 49 years of age at operation in 1942 and who is now well approximately five and one-half years after operation (Jan. 2, 1948), is the subject of the present report.

The operation was performed for hyperinsulinism due to a small adenoma of the islets of Langerhans. During the five and one-half years after pancreatectomy the patient has remained in essentially good health. Her diabetes has continued to be of relatively mild degree as compared with the type of diabetes which commonly occurs in children, adolescents and young adults. In spite of the loss of large amounts of nitrogen and fat in the feces, she has been able to maintain an excellent nutritional state. Despite the fact that her

diet had not been supplemented with choline, lecithin or other lipotropic substance, there was no abnormality of the liver functions which were measured and the values of the blood lipids and serum proteins remained within normal range.

HEMIPELVECTOMY. M. M. Ravitch, *Surgery* 26:199-214 (Aug.) 1949.

The indications and application of hindquarter amputation are discussed and its advantages over hip joint amputation as a treatment of malignant tumors high in the thigh. The author presents a straightforward description of the technic of the procedure. Beginning with an anterior incision along the iliac crest and inguinal ligament is followed by an extraperitoneal elevation of the abdominal contents and ligation of the vessels, nerves and psoas muscle. After transecting the pubis with a Gigli saw, the posterior incision is made. The gluteus maximus is cut across at its origin (the author sees no advantage to the preservation of this muscle) and the piriformis muscle is exposed with the superior and inferior gluteal vessels above and below. These vessels are ligated and transected and the piriformis muscle is cut exposing the sciatic nerve which is ligated and transected. The Gigli saw is then used to transect the sacroiliac joint (if there is no involvement of the bony pelvis with malignant disease, the author sees no objection to leaving small fragments of ilium and pubis). Division of the levator ani and iliocavernosus muscles completes the dissection. After hemostasis, the subcutaneous layer and the skin are closed. Drains are placed at either end of the incision. The patient is put up on crutches on the first postoperative day.

The choice of anesthetic is not important in the author's opinion. Pentothal and nitrous oxide are used on his service (Johns Hopkins Hospital). Shock has not been a factor in his experience but he considers the routine administration of blood from the beginning of the procedure to be important.

Four cases are reported. One was a twelve day old male infant with congenital hemangioma and lymphangioma of a lower extremity involving the pelvis and buttock. The other cases were adults with various malignant diseases. All of these patients survived the operation.

The author feels that the procedure is not unduly complicated and that, in view of the present day low mortality rate, wider application is indicated.

The Southern Surgeon, the second regional journal devoted to a specialty in the United States, is published by The Southern Surgeon Publishing Company, a subsidiary of The Southeastern Surgical Congress, for the advancement of surgery particularly in the South. In addition to publishing papers presented before the Postgraduate Surgical Assembly of The Southeastern Surgical Congress, it welcomes good surgical papers regardless of their geographic origin. It aspires to encourage surgeons in the Southern States, especially the younger ones, to record their own observations and original work.

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The Southern Surgeon is published monthly. Subscription price in the United States and Canada: \$5.00; in other countries: \$6.00, including postage. Single copies, \$1.00 postpaid.

Checks may be made payable to The Southern Surgeon Publishing Co.

